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District of Kenora (Patricia Portion)

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Frontispiece. *Sawan Bay of Slate Lake, looking east.*

Foreword

This report presents the results of a detailed geological survey performed in 1980 and covering the Slate Lake area, east of Red Lake in northwestern Ontario. The survey is a continuation of a multi-year Ontario Geological Survey program to upgrade the geological data base available for and assess the mineral potential of the western part of the Uchi Subprovince.

The Slate Lake area may be of particular significance from an exploration standpoint because of its proximity to and probable stratigraphic association with former producers of base metals and gold in the Uchi–Confederation Lakes area. Indeed, one purpose of this project has been to permit the southwestward extension of volcanic stratigraphy recently interpreted in the Uchi–Confederation Lakes belt.

An additional objective of the survey has been to examine the nature of the English River–Uchi Subprovince transition which transects the southern part of the project area. Tectono-stratigraphic interpretation of such boundaries is of major importance in unravelling Archean geological history.

V.G. Milne

Director
Ontario Geological Survey

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GEOLOGICAL MAP (back pocket)

Map 2517 (coloured)—Slate Lake Area, District of Kenora (Patricia Portion). Scale 1:31 680 (1 inch to 1/2 mile).

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in cooperation with the Coal Association of Canada.

Geology of the Slate Lake Area
District of Kenora (Patricia Portion)

R.P. Bowen

Formerly Geologist, Precambrian Geology Section, Ontario Geological Survey, Toronto.

Manuscript approved for publication by John Wood, Chief Geologist, Ontario Geological Survey, August 30, 1983. This report is published with the permission of V.G. Milne, Director, Ontario Geological Survey.

Abstract

The Slate Lake map area is located about 10 km south of Uchi Lake and 100 km east of Red Lake and covers about 310 km². It lies in the southern part of the eastward to northeastward trending Birch–Uchi metavolcanic-metasedimentary domain on the south margin of the eastward trending Uchi Subprovince, a belt of Early Precambrian metavolcanics and metasediments surrounded by granitic batholiths within the Superior Province of the Canadian Shield. The southern part of the map area south of the Papaonga River and Sydney Lake Fault lies in the English River Subprovince.

The metavolcanics are part of the Uchi Lake metavolcanic series and the metasediments are part of the Slate Lake metasedimentary series (Bateman 1940). The belt is isoclinally folded. The total thickness of the metavolcanic sequence in the map area is roughly 2000 m. The metasediments are estimated to be at least 1500 m thick. Metavolcanics constitute 50 percent of the supracrustal succession. These comprise: ultramafic to mafic massive and pillowed flows with minor pyroclastic, hyaloclastic, and amphibolite units (15 percent); intermediate tuff, lapilli-tuff, and tuff-breccia (25 percent); felsic metavolcanics (10 percent) consisting mainly of tuffaceous pyroclastic material and a few minor flows.

Clastic and chemical metasediments underlie 30 percent of the map area. Clastic metasediments are predominantly subarkosic wacke. A 300 m thick orthoconglomerate formation bisects the map area in an east-west direction. Chemical metasediments make up less than one percent of the map area and consist of banded magnetitic chert or jasper interbedded with magnetite ironstone, some chert beds, and pyrite ironstone in thin beds not exceeding 200 m.

In the southern part of the map area close to the Bluffy Lake Batholith (outside of the map area) metamorphic grade increases from greenschist to amphibolite facies and the metasediments have undergone migmatization. A transi-

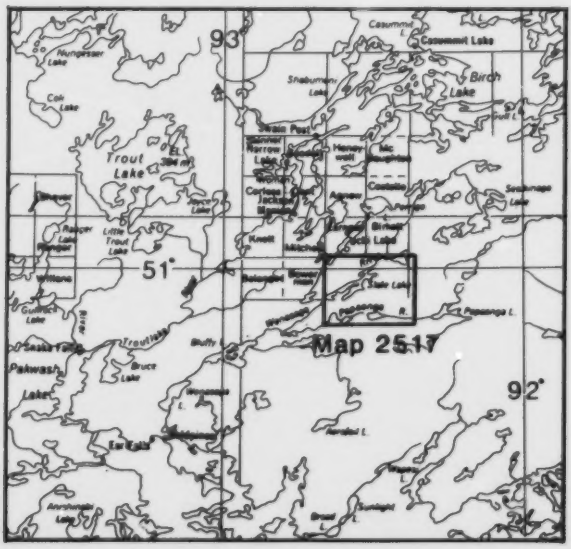

Figure 1. ***Key map showing location of the Slate Lake Area. Scale 1:1 584 000 or 1 inch to 25 miles.***

tion from relatively unaltered wacke to homogeneous diatexite takes place over a north-south distance of roughly 2 km.

Mafic sills and dikes and one stock intrude the metavolcanic-metasedimentary sequence. Some of the large sills or dikes north of Panama Lake may be thick flow units.

Felsic intrusive rocks, both shallow and deep seated, intrude the metasediment-metavolcanic sequence possibly along fold axes or other zones of structural weakness.

Exploration activity has taken place in the area since the 1920s when the Red Lake gold discovery was made. The first stage of exploration activity for gold occurred from the 1920s through the 1940s on a sporadic basis. In the 1950s, Tex-Sol Exploration Limited (11) outlined reserves of roughly 115 000 000 tons of 31 percent iron in the area. (Number in parentheses after property name refers to that property location on map in back pocket.)

The map area lies just south of the site of the Uchi Lake Gold Mines Limited mine and the South Bay Mines Limited volcanogenic massive sulphide copper-zinc-silver mine. The geology is favourable for mineral deposits and continued mineral exploration is expected for some time.

Résumé

La région du lac Slate représentée sur la carte se trouve à quelque 10 km au sud du lac Uchi et à 100 km à l'est du lac Red, sa superficie est d'environ 310 km^2. Elle s'étend dans la partie sud du domaine métavolcanique à métasédimentaire de Birch-Uchi orientée vers l'est-nord-est à la limite sud de la sous-province d'Uchi orientée vers l'est, ceinture de roches métavolcaniques et métasédimentaires du précambrien inférieur entourée du batholites granitiques situés au sein de la province supérieure du bouclier canadien. La partie sud de la région réprésentée par la carte, au sud de la rivière Papaonga et de la faille du lac Sydney, est située dans la sous-province de la rivière English.

Les roches métavolcaniques font partie de la série de roches métavolcaniques du lac Uchi et les roches métasédimentaires font partie de la série de roches métasédimentaires du lac Slate (Bateman 1940). La ceinture présente un pli isoclinal. La série de roches métavolcaniques de la région représentée par la carte a une épaisseur totale d'environ 2000 m. On estime que les roches métasédimentaires ont une épaisseur d'au moins 1500 m. Les roches métavolcaniques forment 50 pour 100 de la série supracrustale. Ces dernières se composent de coulées ultramafiques à mafiques homogènes et en coussinet, accompagnées de petites unités pyroclastiques, hyaloclastiques et amphiboliques (15 pour 100); de tuf intermédiaire, de tuf-lapilli et de tuf bréchique (25 pour 100); de roches métavolcaniques felsiques (10 pour 100) composées essentiellement de matériaux pyroclastiques tufacés et de quelques coulées de moindre importance.

Les métasédiments clastiques et chimiques sont sous-jacents dans 30 pour 100 de la région représentée par la carte. Les métasédiments clastiques sont essentiellement du wacke de grès arkosique. La région représentée par la carte est partagée en deux par une formation d'orthoconglomérat de 300 mètres d'épaisseur orientée vers l'est-ouest. Les métasédiments chimiques sont formés de chert de magnétite ou de jaspe zoné interstratifié avec du minerai de fer de magnétite, quelques couches de chert et du minerai de fer de pyrite en minces couches ne deépassant pas 200 m et constituant moins de un pour cent de la région représentée par la carte.

Dans la partie sud de cette région, à proximité du batholite du lac Bluffy (en dehors de la région représentée par la carte), le degré de métamorphisme a augmenté, passant du schiste vert à un faciès à amphiboles et les métasédiments ont subi une migmatisation. On note la transition d'un wacke relativement inaltéré à une diatexite homogène sur une distance d'environ 2 km en direction nord-sud.

La série du roches métavolcaniques-métasédimentaires est pénétrée de filons-couches et de dykes mafiques. Certains des principaux filons-couches ou dykes situés au nord du lac Panama pourraient être d'importantes coulées.

La série de roches métasédimentaires-métavolcaniques est pénétrée de roches intrusives felsiques, à la fois peu et très profondes, probablement le long des axes de pli ou d'autres zones de faiblesse structurale.

On se livre à la prospection dans cette région dans les années 20, date à laquelle on a découvert les gisements aurifères du lac Red. La première phase de prospection aurifère s'est effectuée sporadiquement entre les années 20 et 40. Dans les années 50, Tex-Sol Exploration Limited (11) a découvert dans cette région des réserves d'environ 115 000 000 de tonnes à 31 pour 100 de fer. (Les chiffres entre parenthèses renvoient au numéro de la propriété porté sur la carte dans la pochette arrière.)

La région représentée par la carte s'étend juste au sud du site de la mine Uchi Lake Gold Mines Limited et de la mine d'origine volcanique de sulfure de

cuivre-zinc-argent massif. La situation géologique est favorable aux dépôts minéraux et on prévoit que la prospection minière se poursuivra encore pendant quelque temps.

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Introduction

Mapping of the Slate Lake area extends detailed (1:31 680) scale-mapping of the mineralized Confederation Lake area (Thurston 1978) southward and toward Red Lake (Milne 1980).

The Slate Lake area is located about 10 km south of Uchi Lake and 100 km east of Red Lake, and is bounded by 50°52′5″ to 51°1.1′N Latitudes (the southern boundary of Earngey and Birkett townships) and 92°22.5′ and 92°37.64′W Longitudes (the eastern boundary of Bowerman Township). The map area covers roughly 310 km^2.

Access to the area is by float- or ski-equipped aircraft from Red Lake or Ear Falls. Transportation within most of the area can be accomplished by canoe on the Papaonga and Wenasaga River systems. Access to the smaller lakes is by airplane or helicopter.

Physiography

The maximum relief is 100 m with normal variations not usually exceeding 30 m. The mean elevation of the area is approximately 400 m. From diamond-drill records, overburden varies from 1 to 3 m in the northern part of the area and from 3 to 10 m in the southern part. Low gravel, boulder, and rock ridges lie interspersed with muskeg swamps and provide about the only breaks in an otherwise monotonous topography.

Overburden varies from organically derived muskeg and peat deposits to glacial and lacustrine clay, sand, and gravel deposits.

One prominent esker was noted 2500 m northeast of Badrock Lake. South of the western end of Avis Lake, a kettle and outwash fan from an end moraine was noted and two raised shorelines were mapped. Well-rounded boulders, mainly granitic but with some metavolcanic material, ranging up to 1 m in diameter were found along the slope of this deposit.

North of Avis and Kesaka lakes and east of Maskooch Lake a series of transverse glacial moraines were noted. These were easily mapped from aerial photographs. They extend 2 to 3 m above the muskeg and are composed of gravel and boulders with some outcrop. The outcrop possibly acted as a dam to glacial ice and caused the gravel to be deposited at that particular location. These moraines are sublacustrine in origin (V.K. Prest, Consulting Geologist, Ottawa, personal communication, 1980) and are discussed in the section on Cenozoic Geology.

For the most part, the lakes have formed in rock basins or along fault traces. Some lakes may also have formed where rock barriers or morainal debris have dammed stream courses. The Wenasaga River, the longest river in the area, provides drainage for nearly all of the northern two thirds of the area. The Uchi River drains the northwestern part of the area and discharges into the Wenasaga River from Ben Lake to the west end of Lower Slate Lake. The Papaonga River drains the southern one third of the area and discharges into the Wenasaga River to the west from Ogani Lake. The Wenasaga River discharges into Lac Seul. These rivers and streams are characterized by long, flooded, sluggish stretches alternating with short lengths of rapids and swift water.

Previous Work

The first geological reports concerning this area are by Dowling (1894), Camsell (1904), and Wilson (1909). These reports were produced under the aegis of the Geological Survey of Canada. After the Patricia Portion was severed from the District of Keewatin of the Northwest Territories and became part of the Province

of Ontario, the Ontario Bureau of Mines combined their works in Volume 21, Part 2 (Miller 1912).

A reconnaissance report by Burwash (1920) was published by the Ontario Department of Mines covering some of the navigable streams and adjoining land. In 1936 part of the easternmost part of the project area was mapped by Wright (1936) for the Geological Survey of Canada.

The first detailed study was undertaken in 1938 by J.D. Bateman and culminated in a PhD dissertation at Yale University (Bateman 1939) and a report for the Ontario Department of Mines (Bateman 1940).

In 1959 an airborne magnetic survey was undertaken jointly by the Ontario Department of Mines and the Geological Survey of Canada. A series of aeromagnetic maps were published in 1960 (Ontario Department of Mines–Geological Survey of Canada 1960a, 1960b, 1960c, 1060d).

In 1965 and 1966, the adjoining area to the west was mapped for the Ontario Department of Mines by Fenwick (1966, 1967). In 1969, the area to the north was mapped by Pryslak (1970) for the Ontario Division of Mines and in 1973 and 1974 by Thurston *et al.* (1974, 1975). All of the map area south of 51°N Latitude was included in the helicopter reconnaissance mapping program by the Ontario Division of Mines in 1975 and is published as Preliminary Map P.1200 (Breaks *et al.* 1976).

Present Geological Survey

The field work for this report was done during the summer of 1980. Vertical aerial photographs at a scale of 1 inch to 1/4 mile, supplied by the Ontario Division of Forests, provided mapping control. The base map was prepared by the Cartography Section, Surveys and Mapping Branch, Ministry of Natural Resources, from map sheets of the Forest Resources Inventory of the Ontario Ministry of Natural Resources. Traverse by pace-and-compass were not spaced at regular intervals, rather, only those outcrops or potential outcrop areas identified on the aerial photographs were visited. It is believed that very few outcrops were missed. The geology in the report is not tied to surveyed lines.

Acknowledgments

The author was assisted in the 1980 field season by Mr. John G. Haggard as senior assistant. He was responsible for a large part of the mapping.

Jonathan Devaney, Margery Osborne, and Elizabeth Jennings acted as junior assistants. Mr. Devaney and Ms. Osborne performed some independent mapping.

The author would like to thank the personnel of Green Airways Limited for many courtesies extended during the field season and the support given by ministry personnel at the Red Lake District Office and from the Resident Geologist's Office at Red Lake. Co-operation on the part of St. Joseph Explorations Limited personnel, notably Wally Rayner and Ray Zalnieriunas, in making data available and in helpful discussions is greatly appreciated. Mr. Charlie Page of Tex-Sol Explorations Limited was most helpful in supplying information regarding their Avis Lake iron deposit. Useful discussions on the area were had with P.C. Thurston, H. Wallace, and F.W. Breaks of the Ontario Geological Survey and V.K. Prest, Consulting Geologist, Ottawa.

General Geology

All the bedrock in the map area is Early Precambrian (Archean) in age (Nunes and Thurston 1980). Bateman (1939) divided the area into north and south halves and assigned them respectively to the Uchi Lake volcanic series and Slate Lake sedimentary series. Since then, the area has been resubdivided (Thurston 1978; Breaks *et al.* 1978) with the northern part assigned to the Uchi Subprovince and the southern part assigned to the English River Subprovince.

Mafic metavolcanics comprise roughly 10 to 15 percent of the map area and fall into Thurston's (1978) Cycle I (equated with Bateman's Uchi Lake volcanic series) except for a small part in the northwestern corner which is upper Cycle II metavolcanics (Thurston 1978). Most of the Cycle I metavolcanics are mafic to intermediate in composition and vary from massive and pillowed flows to pyroclastic rocks. Some coarse-grained phases are present, some of which may be intrusive. Pillow selvages as well as flow banding were noted. Interbedded with the mafic metavolcanics are intermediate (10 to 15 percent) and felsic (15 to 20 percent) metavolcanics and clastic metasediments (30 percent). The intermediate and felsic metavolcanics are mostly ash to lapilli-sized pyroclastic rocks; flows were rarely observed.

The clastic metasediments vary from arkose to wacke in composition. Many of the units are derived from felsic to intermediate volcanic debris and in some areas graded bedding and crossbedding are much in evidence. A formation of polymictic pebble and cobble conglomerate with an arkose to wacke matrix extends about 12 km from Lower Slate Lake to Maskooch Lake and is 300 to 450 m thick. The formation comprises a succession of conglomerate and wacke units which vary from a few centimetres to 6 m thick. Volcanic and sedimentary clasts comprise 80 percent of the cobbles and pebbles, which are smooth and oval in shape. Granitic and intrusive rock clasts comprise the remaining 20 percent of the clasts and are generally well rounded and show little deformation. The plutonic clasts have not been correlated with plutonic bodies in the map area. The conglomerate has been described as an alluvial fan type deposit by Bateman (1940). Chemical metasediments observed in the map area are magnetitic chert and jasper interlayered with magnetite ironstone and sulphide facies ironstone. Specular hematite is associated with the jasper-rich unit. These units along with carbonatized zones appear to be associated with the contact between felsic metavolcanics and metasediments. The chemical metasediments comprise 1 to 5 percent of the rock types in the map area.

In the southernmost part of the map area migmatitic rocks derived from wacke occur. Metamorphic minerals, sillimanite, andalusite, muscovite, tourmaline, and garnet, are present in these rocks which range from metasedimentary muscovite schist to homogeneous diatexite (Mehner 1971) or 95 percent medium- to coarse-grained leucocratic granite pegmatite (Breaks *et al.* 1976, 1978).

Mafic to intermediate intrusive rocks underlie 5 to 10 percent of the map area; the largest body of this type being the Tepeka Lake Stock is dioritic in composition. Medium- to coarse-grained gabbroic to dioritic sills and dikes intrude the metavolcanics and metasediments throughout the map area but are most common in the northern part.

Four silicic plutons of deep-seated to shallow intrusive origin and several feldspar porphyry dikes and small intrusive bodies make up approximately 15 percent of the map area. The four plutons are composed of granodiorite, tonalite, quartz syenite, granite with pegmatitic phases, and quartz-feldspar porphyry. The intrusions range in size from 1 to 3 km wide by 2 to 6 km long, with the length paralleling the regional foliation trend. It is possible that the hypabyssal intrusion

TABLE 1. TABLE OF LITHOLOGIC UNITS FOR THE SLATE LAKE AREA.

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Till, clay, sand and clay, gravel

Unconformity

PRECAMBRIAN

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Aplite, pegmatite, granite, granodiorite, quartz syenite, quartz syenite-K-feldspar phyric, tonalite with biotite clots

Intrusive Contact

FELSIC TO INTERMEDIATE SUBVOLCANIC ROCKS

Granite feldspar porphyry, granite quartz-feldspar porphyry, granodiorite feldspar porphyry, tonalite feldspar porphyry

Intrusive Contact

MAFIC TO INTERMEDIATE INTRUSIVE ROCKS

Gabbro, epidote-rich gabbro, epidote-rich quartz gabbro, diorite, quartz diorite, lamprophyre

Intrusive Contact

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

Chemical Metasediments

Chert, magnetite-bearing chert interbedded with magnetite ironstone, magnetite-bearing jasper interbedded with magnetite ironstone, pyrite ironstone

Clastic Metasediments and Derived Migmatites

Mudstone, arenite, arkose, wacke, orthoconglomerate; paraconglomerate, protometatexite, metatexite, inhomogeneous diatexite and homogenous diatexite; sillimanite-bearing metatexite, diatexite; staurolite-bearing protometatexite; tourmaline-bearing diatexite; andalusite schist protometatexite; garnet metatexite, diatexite; muscovite schist, metatexite, diatexite

METAVOLCANICS

Felsic Metavolcanics

Massive flow, tuff, lapilli-tuff, lapillistone, tuff-breccia, pyroclastic breccia, porphyritic pyroclastic rock (feldspar phenocrysts)

Intermediate Metavolcanics

Tuff, lapilli-tuff, lapillistone, tuff-breccia, pyroclastic breccia, autoclastic breccia, porphyritic pyroclastic rock (feldspar phenocrysts) and porphyritic flow (feldspar phenocrysts), porphyritic pyroclastic rock (amphibole phenocrysts)

Mafic Metavolcanics

Massive flow, pillowed flow, porphyritic flow (amphibole phenocrysts), porphyritic flow (feldspar phenocrysts), pillow breccia, tuff, lapilli-tuff, autoclastic breccia, amphibolite, garnetiferous amphibolite

centred around Maskooch Lake is a thick massive part of the felsic metavolcanic sequence surrounding the intrusion.

The entire area has been glaciated. The most obvious glacial trend is from northeast to southwest but in places two sets of striations occur with the second trending roughly 20 degrees more southward.

The general structural trend of the rock formations is east with dips steeply to the south to vertical. Very little evidence exists for northward trending faults and little stratigraphic dislocation was noted along possible east-west trending faults, the most notable of which is parallel to the long axis of Slate Lake. Bedding and foliation strikes are in general conformable, although a few schistosities were noted with a strike at an angle to bedding.

EARLY PRECAMBRIAN (ARCHEAN)

METAVOLCANICS

Metavolcanics, including water-laid pyroclastic rocks, comprise roughly 50 percent of the rocks in the map area. The metavolcanics have been subdivided into three groups based upon the total mafic mineral content of the rock (chlorite, amphibole, biotite, and pyroxene).

For this report felsic metavolcanics are defined as those rocks having a mafic mineral content of less than 15 percent; intermediate metavolcanics have mafic mineral content of between 15 and 35 percent and mafic metavolcanics contain greater than 35 percent mafic minerals.

To facilitate correlation with mapping in adjacent areas reference is made in the following descriptions to the cycle volcanic succession established by Thurston (1978).

There are no Cycle III metavolcanics in the map area. Cycle II metavolcanics which are mostly intermediate are confined to the extreme northwestern part of the area. Whereas no Cycle II mafic metavolcanics are present in this northwestern part, a geological trend south from Earngey Township (Thurston 1975) and aeromagnetic data (Ontario Department of Mines–Geological Survey of Canada 1960b) tend to suggest their presence.

Mafic Metavolcanics

Mafic metavolcanics make up roughly 15 percent of the rocks in the map area and nearly all of them fall into Cycle I of the Uchi Lake area (Thurston 1978). Most of the mafic metavolcanics are massive or pillowed basaltic lava flows ranging from 15 to 150 m thick. Most flow contacts could not be located except along the north shore of Slate Lake and north of Slate Lake where outcrop is fairly extensive and considerable stripping of moss was done. Thinner, discontinuous beds of intermediate tuffaceous metavolcanics and metasediments are found among the mafic lavas. Pillow breccia or hyaloclastite zones were noted (Photo 1). Tops of flows are generally characterized by a 20 cm breccia zone, somewhat more felsic than the lower part of the flow. The upper contact is with a medium-grained flow unit which commonly has weakly developed pillows (Photo 2). These weakly developed pillows have 3 mm selvages and may be compressed into oval shapes 5 to 10 cm by 30 or more centimetres long. A breccia zone about 5 cm thick may be present along the bottom of the overlying flow. Pillows become better developed higher in the overlying flow (Photo 3).

Where contacts were not observed some units mapped as coarse-grained flow may in fact be sills or dikes. Only one chilled, intrusive margin was observed located on the east shore of the large island in Sawan Bay of Slate Lake where a gabbro sill intrudes clastic metasediments. In the absence of other evidence, thick

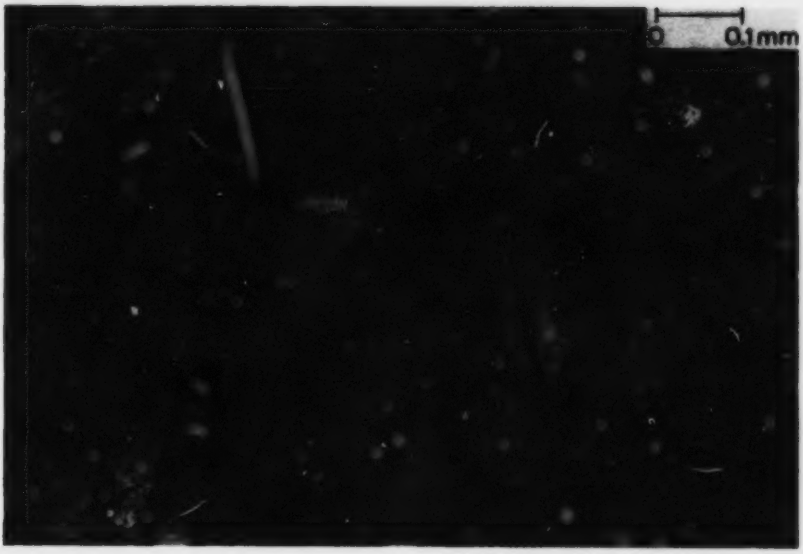


Photo 1. *Pillow breccia in mafic metavolcanics, north shore of Slate Lake.*

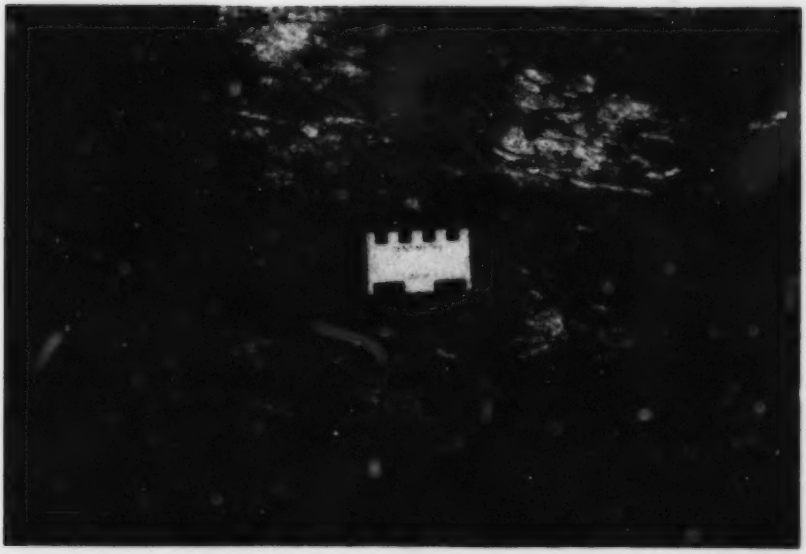


Photo 2. *Weakly developed pillows in mafic metavolcanics, north of Slate Lake.*

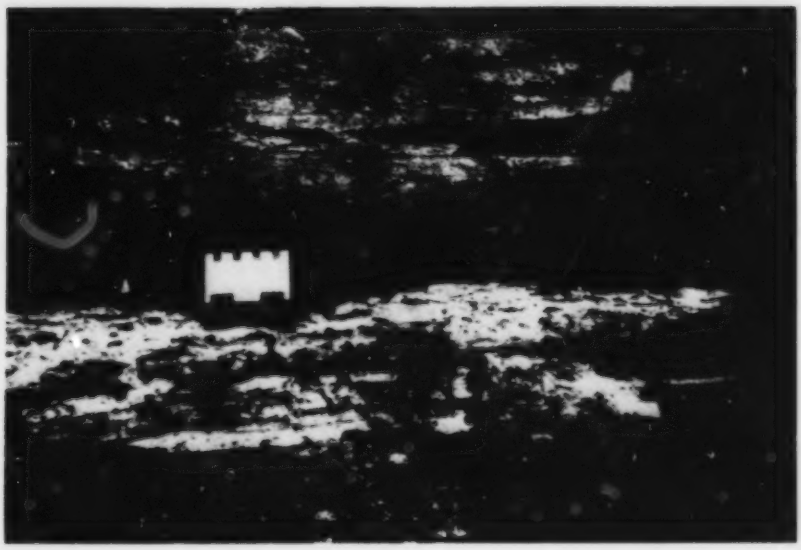


Photo 3. *Contact between two mafic metavolcanic flows. Flow-top breccia of intermediate composition overlain by coarser grained more mafic flow with some weakly developed pillows. North of Slate Lake.*

units, such as those which extend south of Leg Lake through the Bowerman Township boundary, are at least 500 m thick, and have a grain size of 3 to 5 mm or greater, were mapped as intrusions. Similar units occur trending eastward from Slate Lake to south of Jubilee Lake. The metasediments adjacent to the metavolcanics are intruded by many small mafic dikes and sills.

Petrographically, the mafic metavolcanic flows which make up the bulk of the mafic metavolcanics are composed of the following: quartz, up to 20 percent; plagioclase An_{26-37}, 15 to 40 percent; amphibole including actinolite and hornblende, 30 to 50 percent; chlorite, 10 to 15 percent; biotite, 5 to 10 percent; and some relict pyroxene with minor amounts of sphene, apatite, iron-titanium oxides, leucoxene, and carbonate. Much of the quartz in these rocks is considered by the author to be a product of alteration.

The aphanitic groundmass appears under the microscope to be composed predominantly of plagioclase, amphibole, and Fe-Ti oxides as subhedral to euhedral inequigranular crystals 0.006 to 0.012 mm in long dimension.

The flow units have trachytic texture and are well foliated. Some parts are vesicular but rarely amygdaloidal. No variolitic textures were noted. Porphyritic flow units are present. Those containing amphibole phenocrysts generally tend to be thinner flows whereas those containing feldspar phenocrysts tend to be thicker.

A number of thin flow units with aphanitic groundmass and amphibole phenocrysts up to 2 mm in long dimension were noted between Upper Slate Lake and Slate Lake.

Mafic flows and pillowed flow units generally not exceeding 3 to 10 m thick were traced from Bowerman Township east through Lower Slate Lake, Wassa Bay, and between Kesaka and Avis lakes through to the eastern boundary of the

map area. Pillow flows were also noted along the peninsula between Wassa Bay and Sawan Bay of Slate Lake and south of Kesaka Lake. Tops face south at both these latter locations. Petrographically, these rocks are composed of 40 to 60 percent amphibole and chlorite, less than 5 percent quartz, about 30 percent plagioclase, and 1 to 3 percent pyrite. The rocks are aphanitic generally with some parts ranging up to 2 to 3 mm in grain size. The rocks are dark greenish grey and weather to a dull greenish brown.

A massive mafic metavolcanic flow about 100 m thick extends from roughly 2 km east of West Badrock Lake and south of the Papaonga River system, eastward through the eastern boundary of the map area. This unit is medium grained (2 to 3 mm), is chloritized and the feldspar is saussuritized. It is medium grey and weathers brownish grey to brownish white.

Roughly 500 m north of Kesaka Lake, a 300 m thick by 3500 m long highly metamorphosed mafic to ultramafic metavolcanic sequence was noted. Part of the unit is a garnetiferous amphibolite and the individual garnets average 3 to 5 mm in diameter with some in excess of 1 cm. Minerals present are hornblende and actinolite, each in amounts of about 20 to 30 percent; iron-titanium oxides 5 to 7 percent; carbonate up to 1 percent; quartz 1 to 3 percent; chlorite 15 to 20 percent; and garnet 10 to 15 percent. Quartz and garnet also occur as ptygmatic veins and along boundaries of what appear to be pillows although they have been extremely deformed.

In contact with and north of this garnetiferous amphibolite, a garnet-rich banded rock is noted. The dark bands are roughly 1 to 1.5 cm wide and are locally discontinuous and may show some grading in the lighter bands. Garnets are preferential to neither bands. This rock may be of pyroclastic origin.

The author interpreted banding in the fine-grained mafic rocks and fragments in the coarser or more massive units to be an indication of pyroclastic origin. Pyroclastic mafic metavolcanics vary from tuff to lapilli-tuff but in general are rare. One possible example of a mafic autoclastic breccia occurs on the south shore of Upper Slate Lake although this rock may be intermediate in composition.

Carbonatization is extensive throughout all metavolcanics and most metasediments. Along both the north and south shores of Slate Lake and the north shore of Sawan Bay of Slate Lake, 5 to 15 cm dark brown carbonate pods formed parallel to the foliation. Quartz veins and sulphide minerals are not commonly associated with these carbonate zones, however.

Intermediate Metavolcanics

Intermediate metavolcanics comprise roughly 20 to 25 percent of the rocks in the map area and are confined to the northern half and northwestern parts. They include tuff, lapilli-tuff, and lapillistone.

With reference to Thurston's (1978) classification of volcanic cycles, one unit of Cycle II intermediate metavolcanics extends southward from the Confederation Lake area into the map area. This unit cuts through the northwestern corner of the map area northwest of Neepawa Bay and is approximately 200 m thick. It is a porphyritic tuffaceous andesite with amphibole phenocrysts compared with the Cycle I intermediate metavolcanics which are dacitic.

The intermediate metavolcanics, equivalent to Thurston's Cycle II, in the map area are light to medium greyish green and weather light grey to white. Metamorphic foliation is poorly developed and original bedding planes are well preserved.

Intermediate metavolcanics of pyroclastic character are the only representatives of Thurston's Cycle I intermediate metavolcanics within the map area, but

they are the predominate intermediate metavolcanic unit therein. These Cycle I rocks occupy much of the area north of a line from Anape Lake to Islay Lake and most commonly comprise dacitic fine-grained tuff, crystal and lithic lapilli-tuff, and lapillistone. The most abundant rock type is tuff to lapilli-tuff of dacitic composition. This rock type accounts for roughly 80 percent of the intermediate metavolcanics. Tuff and lapillistone account for 5 percent; coarse pyroclastic breccia and coarse autoclastic breccia comprise roughly 10 percent and a series of 20 to 60 m thick intermediate flows with feldspar phenocrysts make up the final 5 percent. About half of the lapilli and breccia fragments are dacitic to rhyolitic in composition; the other half are pumiceous. The lapilli range in size from 2 to 40 mm and the breccia fragments up to 15 cm.

Some crystal tuff, notably near where Slate Lake flows into Lower Slate Lake, on first examination appears to be porphyritic flows, however thin section examination reveals subangular feldspar and quartz crystals and lithic fragments. Wispy chloritized micaceous material is present around the individual crystals and rock fragments. The feldspars are plagioclase An_{28-30} and have been extensively sericitized and carbonatized. The unit is a porphyritic flow with feldspar phenocrysts.

Tuff-breccia and pyroclastic breccia were noted south of Slate Lake east of Sawan Bay. South of Maskooch Lake an autoclastic fragment-supported breccia roughly 400 m thick and 5 km long contains altered intermediate to felsic fragments, 1 to 3 cm in long dimension with some up to 30 cm in a mafic to intermediate matrix. The matrix is quite chloritic and the fragments are very angular which may indicate a base surge deposit. Enrichment of the finer grained matrix by magnesium during rock/seawater interaction could have caused the matrix to become more chloritic than the fragments.

North of Kesaka Lake a pyroclastic breccia to tuff-breccia outcrop is on a large rock hill about 50 m above the surrounding landscape. Epidotization and albitization were noted along joint planes. This rock is monolithic and mostly fragment supported but with some matrix-supported parts. Fragments are subangular and range in size from 3 to over 30 cm. It is 500 m thick and extends eastward where it is more tuffaceous.

North of Panama Lake and north of Slate Lake the intermediate metavolcanics are intercalated with mafic units and thin felsic metavolcanic units are intercalated with the intermediate units.

The intermediate metavolcanic formation extending east from Sawan Bay of Slate Lake through Maskooch Lake and past the eastern boundary of the map area consists of a sequence of 20 to 30 m thick units which appear to be isoclinally folded about an eastward trending synclinal axis that is cut by the Maskooch Lake Stock.

Graded bedding was noted in tuff and lapilli-tuff along the north shore of Upper Slate Lake. Megascopically the rocks are indistinguishable from clastic metasediments, however, when the rock was slabbed, stringers of crushed pumice and lithic fragments are readily apparent and in thin section even more obvious.

Petrographically the intermediate metavolcanics contain 20 to 25 percent quartz although some specimens contain as much as 40 percent. Potassic feldspar, where present, will generally compose 5 to 10 percent of the rock and plagioclase ranges from 25 to 30 percent at An_{25-30}. Hornblende rarely exceeds 25 percent, if present at all, and biotite is far more common ranging from 10 to 30 percent. Generally the less hornblende present, the more biotite will be noted. Iron-titanium oxides, leucoxene, and pyrite range from 1 to 10 percent. Alteration minerals are carbonate, sericite, chlorite, and epidote. Accessories are zircon, apatite, and sphene.

The rocks are generally greenish grey to dark grey contrasted with dark greenish grey to dark greenish black for mafic metavolcanics. The intermediate rocks weather brownish grey compared to brownish black for the mafic rocks.

Felsic Metavolcanics

Felsic metavolcanics comprise about 5 to 10 percent of the map area. These rocks are rhyolite, and rhyodacite to dacite and they are predominantly of pyroclastic origin. In relation to the volcanic cycles established by Thurston (1978) there are no Cycle III felsic metavolcanics in the map area and only one outcrop representing a small intercalated felsic to intermediate unit approximately 100 m thick within the Cycle II intermediate tuffaceous unit which underlies Neepawa Bay. For mapping purposes it has been classified as intermediate. Metavolcanics which correlate with Thurston's Cycle I occupy much of the north half of the map area and several felsic tuff to lapilli-tuff units are intercalated with intermediate pyroclastic units of this Cycle. These units are 20 to 100 m thick and range in length from 1 to 6.5 km and are most prevalent intercalated with the intermediate metavolcanic unit trending eastward from the Bowerman Township boundary in the vicinity of Anape Lake and ending north of Upper Slate Lake along the Wenasaga River. These units probably represent more felsic phases of the particular intermediate stage of volcanism rather than a separate felsic stage.

A felsic pyroclastic unit 400 to 1000 m thick extends from the Bowerman Township boundary north of Lower Slate Lake eastward and terminates northwest of Kesaka Lake. This unit is predominantly tuff to lapilli-tuff with intercalated zones of pyroclastic breccia (Photo 4), tuff-breccia, and lapillistone.

The largest formation of felsic metavolcanics consists of tuffaceous and flow units and extends east from the western boundary of the map area south of Lower Slate Lake gradually pinching out in the metasediments west of Avis Lake. Be-

Photo 4. ***Felsic pyroclastic breccia on the north shore of Lower Slate Lake.***

cause of the general trend and stratigraphic position of this formation it has been correlated with Thurston's (1978) Cycle I. Massive rhyolite flows were noted only along the southern extremity of the Wassa Bay Pluton and along the small pond between the Wassa Bay and West Badrock Lake plutons.

A 100 to 200 m thick unit of felsic tuff to lapilli-tuff can be traced from the pond south of the Papaonga River between West Badrock and Badrock lakes eastward through the boundary of the map area.

The felsic tuffaceous and pyroclastic units are altered to quartz-sericite schist and are generally yellowish grey to yellowish green and weather light grey to greyish white. The flows are black and weather greyish brown. Flows comprise less than one percent of the felsic metavolcanics.

Grain and crystal sizes range from 0.016 to 0.50 mm with phenocrysts to 2 mm and lithic fragments from 5 mm to an average of 10 cm with maximum measured fragments on Lower Slate Lake to 80 cm.

Mineral assemblages vary considerably with some of the more silica-rich rocks containing 60 to 80 percent quartz. The average quartz content, however, seems to be 25 to 30 percent. Potassic feldspar content does not appear to be as high as in the felsic plutonic rocks. Petrochemistry seems to indicate that potassium content is within the normal limits for this class of rocks. Plagioclase content ranges from 5 to 25 percent with an average of 5 to 10 percent and An content An_{24-30} with an average 26 to 28. Most of the feldspar has been saussuritized and kaolinized to some degree. Hornblende does not exceed 3 to 5 percent; biotite averages 5 to 10 percent with some examples over 20 percent. Iron-titanium oxides, pyrite, epidote, actinolite, carbonate, and chlorite make up accessory and alteration products.

The amount of pyroclastic material compared to the relatively small amount of felsic flow material indicates a Vulcanian or Peléean type of eruption according to Macdonald's (1972) classification.

METASEDIMENTS

Metasediments make up just over 30 percent of the rocks in the map area with chemical metasediments equivalent to about one percent. The chemical metasediments are chert, magnetitic chert, or jasper interbedded with magnetite ironstone and pyrite ironstone. The sulphide ironstones are relatively limited in extent. The oxide ironstones attain thicknesses of 200 m and lengths of 4 km, however, when their total areal extent is compared to that of the map area they do not exceed one percent.

The more plentiful clastic metasediments consist of conglomerate, sandstone, and mudstone.

Migmatized metasediments of the English River Subprovince have been grouped with the clastic metasediments and comprise roughly 5 percent of the map area. They are classified according to the system of Mehnert (1971) and Breaks *et al.* (1978).

The metasedimentary sequence south of Slate Lake is estimated by the author to be at least 1500 m thick and may exceed 6000 m.

Clastic Metasediments

CONGLOMERATE

The terminology used in classifying the clastic metasediments is based on the size classification of Wentworth (1927) and the depositional criteria applied by Pettijohn (1957).

A conglomeratic unit was mapped from Lower Slate Lake east through Sawan Bay, continuing eastward and south of Maskooch Lake to the eastern boundary of the map area.

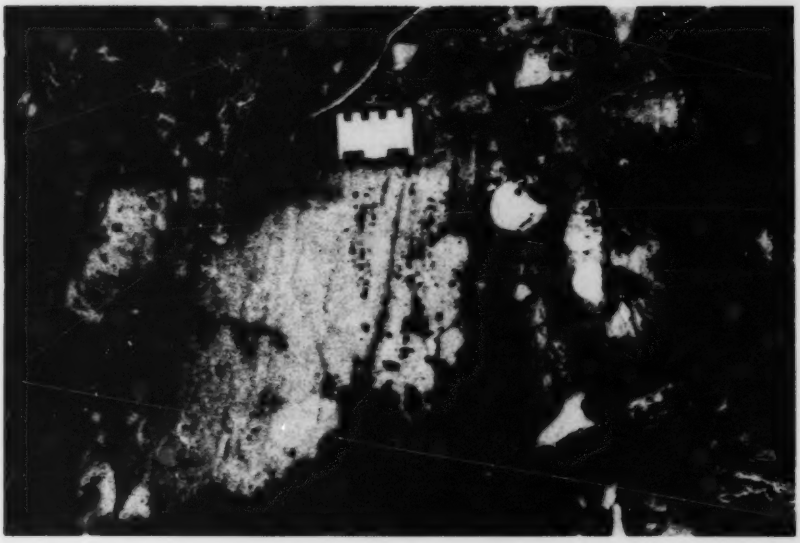


Photo 5. *Two conglomerate beds separated by a bed of subarkosic wacke on a small island east of the large island in the east end of Sawan Bay.*

The maximum thickness of this unit is 450 m but it is composed of lenticular beds varying from a few centimetres up to 6 m thick (Photo 5). The cobbles are lenticular except for the intrusive and quartzite types which are rounded. This indicates very little deformation or stretching. An examination of physically weathered metavolcanics and metasediments in this area shows that these rocks weather in plate-like (or slate-like) shapes. Hence the name Slate Lake. If these loose fragments were consolidated in a sandy matrix they would appear to have been elongated. The matrix shows no deformation upon microscopic examination. Clasts are 3 to 30 cm long with an average of 7 to 10 cm. Some beds have fragments between 2 mm and 5 cm. Usually the clast length is three times the width. The matrix is an arkose with some wacke. The finer interbeds are arkose to wacke. The colour of the conglomeratic unit is medium to dark grey weathering light grey to tan.

Bateman (1940, p.9) conducted a statistical study of clast content of two parts of this conglomerate. In sample number 1, 373 pebbles constituted 85 percent of the rock and in number 2, 211 pebbles constituted 80 percent of the rock. The modified results are tabulated in Table 2 together with modal analyses of clasts conducted by the author at several locations along the strike of the conglomerate unit.

This conglomerate is predominantly an orthoconglomerate and is similar to Pettijohn's (1957) description of "great" conglomerates. He states that these are thick basin-margin accumulations that are wedge shaped and have been rapidly shed from sharply elevated highlands. The conglomerates are poorly sorted but graded bedding can be detected in the arkose and wacke parts.

Matrix-supported paraconglomerate was observed at three locations: on the south side of the island in Sawan Bay; about 1 km east of Sawan Bay; and north

TABLE 2. CLAST COUNTS AND ESTIMATES OF THE SLATE LAKE CONGLOMERATE (In percent).

Clast Type	Bateman No.1*	Bateman No.2*	Bowen No.1	Bowen No.2	Bowen No.3	Bowen No.4	Bowen No.5
Mafic metavolcanics	38	38	40	30	35	35	10
Felsic metavolcanics	22	35	40	50	40	40	40
Metasediments	1	2	15	–	–	–	5
Chert and Quartz	6	4	–	10	5	5	30
Ironstone	7	–	–	–	–	–	–
Plutonic rocks	26	21	5	10	20	20	15
Percent Total Clasts	85	80	85	80	75	80	80

**J.D. Bateman 1940, p.9*

TABLE 3. CLAST ESTIMATES OF THE KESAKA LAKE CONGLOMERATE (In percent).

Clast Type	Bowen No.6	Bowen No.7	Bowen No.8	Bowen No.9	Bowen No.10
Mafic metavolcanics	20	15	15	10	5
Felsic metavolcanics	40	30	35	30	45
Metasediments	40	30	30	30	30
Chert and quartz	–	5	5	10	5
Ironstone	–	15	10	10	15
Plutonic Rocks	–	5	5	10	–
Percent Total Clasts	85	90	85	70	60

of the ultramafic garnetiferous amphibolite north of Kesaka Lake. These conglomerates are likely the result of local turbidity currents where the boulders either slid into thick deposits of mud or were caught up with large quantities of mud and moved along with the mud en masse.

Two interformational conglomerates in intermediate metavolcanics were noted north of Kesaka Lake. These are orthoconglomerates in the pebble to cobble size range. The conglomerates contain a considerable amount of ironstone. The author made five modal estimates of clast type in these conglomerates, the results of which are in Table 3.

The proportion of plutonic clasts is markedly lower and the proportion of metasediment clasts higher, including chert and ironstone compared to the Slate Lake conglomerates. A decrease in clast size was also noted. The sequence is poorly sorted and clasts show a close relationship to underlying rock types. Better sorted pebbly conglomerate is noted higher in the sequence and crossbedding is present in wacke and arkose.

SANDSTONE

The sandstones are predominantly subarkosic wacke with some arkose, wacke, and micaceous sandstone (quartz arenite). These variations were not observable in the field but were noted in thin section. The subarkosic wacke contains 70 to 80 percent 0.05 to 0.5 mm subangular to subrounded fragments of the following: quartz 20 to 40 percent, orthoclase 7 to 15 percent, and plagioclase 20 to 30 percent; with lesser amounts of biotite, muscovite, andalusite, garnet, epidote,

carbonate, and iron-titanium oxides. The fragments are in a fine-grained matrix averaging from argillaceous material up to 0.05 mm grain size.

Lithic fragments were observed only in the coarser parts of the wacke beds and are not designated as a separate map unit. Most of the lithic fragments are quartz, derived possibly from vein quartz or from granitic material related to the granitic clasts in the conglomerate. The rocks are medium to dark grey and weather brownish grey.

The wackes are found interbedded with and as the matrix in the conglomerate described above and in extensive units particularly in the southern half of the map area. Beginning in the north a fine-grained subarkosic wacke unit about 400 m thick trends northeastward along the west shore of Neepawa Bay. This unit lies at the base of Cycle II or the top of Cycle I metavolcanics of Thurston's (1978) classification. There is uncertainty as to just where the dividing line between Cycle I and Cycle II should be placed (P.C. Thurston, Geologist, Ontario Geological Survey, Toronto, personal communication, 1980). A large area of arkosic and wacke metasediments extends west, south, and north from Jubilee Lake, east of the base of Thurston's (1978) Cycle I metavolcanic sequence.

The Slate Lake metasedimentary series of Bateman (1940) begins with a 300 m sequence of fine-grained subarkosic wacke and mudstone which can be traced along both shores of Slate Lake.

Stratigraphically higher and to the south a sequence of pebble conglomerate, wacke, and mudstone is present along the south shore of Sawan Bay and can be traced east to the eastern boundary of the map area. This sequence is separated from the orthoconglomerate that passes through the centre of the bay by a felsic metavolcanic sequence about 200 m thick. Numerous magnetitic chert interbedded with magnetite ironstone units are found within the metasedimentary unit near Kesaka Lake.

Still higher in the stratigraphic section and south of Lower Slate Lake a 1500 m thick sequence of wacke and subarkosic wacke is bounded to the north by mafic metavolcanics and to the south by felsic metavolcanics. This unit can be traced east where it thickens to 3000 m south of Tepeka Creek, and narrows to about 1000 m south of the Tepeka Lake Stock where it merges with a sequence of subarkosic wacke which occupies most of the south quarter of the map area in the vicinity of the Papaonga River.

The subarkosic wacke can be traced some 11 km south from just north of West Badrock Lake to the contact with the Bluffy Lake Batholith to the west out of the map area. This sequence is remarkably uniform in composition and grain size even though there are units of mafic and felsic metavolcanics and ironstone interbedded with it and felsic plugs and dikes intrude the sequence at several locations. Near the Bluffy Lake Batholith and south of the Papaonga River system, metamorphic grade increases and the metasediments begin to show increased effects of migmatization. The first stage noted is feldspathization and metablastesis in which poikiloblastic feldspars, garnet, andalusite, and staurolite are developed. Primary bedding features are preserved and the leucosome to paleosome ratio is less than 1:10. Increasing metamorphic grade is marked by the appearance of sillimanite, by the increased development of garnet and muscovite, and by the general absence of andalusite as well as by the appearance of medium-grained to pegmatitic leucosome material paralleling bedding planes and rimmed by biotitic melanosome about 2 mm wide. The leucosome and paleosome ratio ranges from 1:10 to 3:5 (Breaks *et al.* 1978) (Photo 6). These rocks are classified as protometatexite and metatexites (Breaks *et al.* 1978) and primary bedding features may, or may not be present. With further increase in metamorphic grade, encountered within 4 km of the Bluffy Lake Batholith, inhomogeneous diatexites begin to form with leucosome to paleosome ratio 3:5 to 9:10 and very

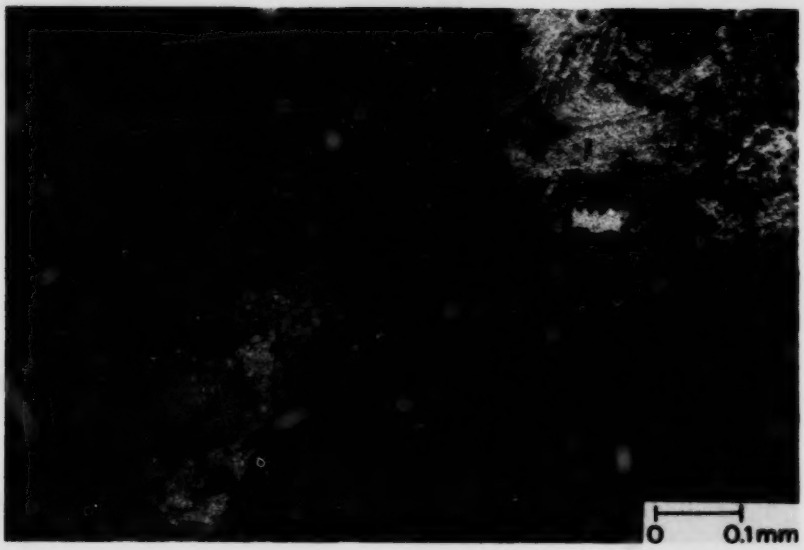


Photo 6. *Metatexite. Granitic, pegmatitic leucosome intruding along bedding planes of wacke paleosome south of the Papaonga River.*

little if any primary bedding left intact. This stage passes fairly rapidly, usually within 200 m into the homogeneous diatexite stage where anatexis is relatively complete, leucosome to paleosome ratio being greater than 9:10.

Three occurrences of quartz arenite in the form of fine-grained micaceous sandstone were found interbedded with felsic metavolcanics. These are located south of Lower Slate Lake, south of the Papaonga Lake Pluton, and interbedded with the intermediate metavolcanics east of Sawan Bay. These arenite units are less than 10 m thick, but may persist for some distance. The unit south of the Papaonga River was traced for 1500 m along strike. These quartz arenites may have been derived from the felsic and intermediate metavolcanics with which they are spatially associated.

Quartz content is between 60 and 80 percent, orthoclase 5 to 10 percent, plagioclase 0 to 5 percent with the balance made up of biotite, muscovite, garnet, epidote, and iron-titanium oxides. They are equigranular and subangular to subrounded. Grain size ranges from 0.06 to 0.25 mm. Fine-grained matrix material less than 0.004 mm comprises no more than 3 percent of the rock. Quartz is strained and partial to complete recrystallization has taken place. The rocks are medium grey and weather to a greyish brown.

MUDSTONE

Mudstone is widely dispersed among the clastic metasediments although it occurs in relatively thin beds from a few tenths of a millimetre to 5 to 10 cm. It occurs mostly as tops to the coarser grained underlying clastic metasediments. The mudstones are darker grey than the coarser wacke and weather a darker brown. Some are black carbonaceous argillite or slate and occur in belts 100 to 200 m thick most notably along the north shore of Slate Lake and the south shore of Sawan Bay, and at Tepeka Lake. They commonly are interbedded with fine, less

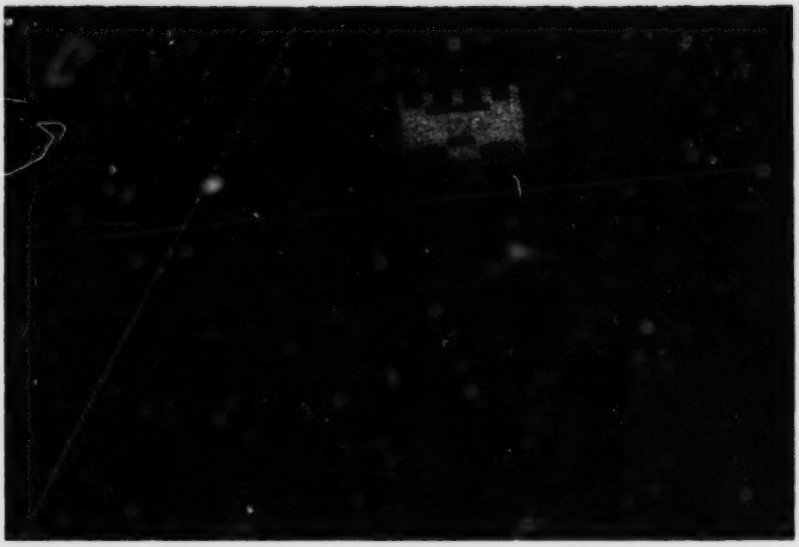


Photo 7. *Flame structures of dark mudstone into overlying pale wacke, Avis Lake.*

than 1 cm, bands of sandy material in which grading may be noted and tops determined and flame structures commonly intrude overlying clastic metasediment (Photo 7). In thin section grain size below 0.001 mm was noted with an average range of 0.002 to 0.005 mm. Some lithic fragments and a few rounded quartz grains up to 0.05 mm were noted. Quartz averaged 20 to 30 percent with feldspar in similar quantity and varying amounts of garnet, sericite, epidote, biotite, hornblende, iron-titanium oxides, sulphides, and graphite.

Along the north shore of Sawan Bay an andalusite-bearing muscovite schist was traced along strike for 400 m and over a thickness of 60 m. Porphyroblasts of andalusite averaging 5 mm and some exceeding 1 cm occur in a very fine grained muscovite and quartz matrix. The porphyroblasts are incompletely formed and smaller ghosts appear to be the beginning of new porphyroblasts. Chemical analysis of this rock type shows high magnesium content of 32.3 percent, no detectable iron, and a sodium plus potassium content roughly seven times greater than the magnesium plus calcium content. Near the eastern contact of the West Badrock Lake Pluton on the Papaonga River, an outcrop of andalusite-bearing mica schist was observed; the andalusite has been altered to quartz and sericite. The andalusite crystals are up to 1 cm long by 2 to 5 mm wide and concentrated along the top 3 to 5 cm of wacke beds that are 10 to 30 cm thick. The West Badrock Lake Pluton may have provided the source of heat for this metamorphism.

Chemical Metasediments

The chemical metasediments are magnetitic chert interbedded with magnetite ironstone and pyrite ironstone generally with some associated chert. Near Tepeka Lake the chert beds are jasperitic. (The term ironstone is used here as defined in the unpublished classification manual of the Ontario Geological Survey, issued in 1978. It is a chemical sedimentary rock that contains 33 percent or more of the

common iron minerals by volume. This definition excludes other chemically precipitated sediments such as chert, and clastic sedimentary material that are commonly interlayered with ironstone.)

Units of interbedded chert and magnetite ironstone range from 20 to 200 m thick over lengths from 500 m to over 4 km. A number of channel samples taken by the author and analyzed by the Geoscience Laboratories, Ontario Geological Survey, Toronto, have iron contents ranging from 16.2 to 38.7 percent. None are at present of economic interest, however, a deposit of approximately 115,053,931 tons of 31.2 percent Fe to a depth of 440 feet (Northern Miner Press 1980-81, 268) is contained within a 124 claim block brought to lease by Tex-Sol Explorations Limited (11) near Kesaka Lake. This deposit is the largest in the area measuring roughly 4 km in length with an average width of 130 m. The deposit is described under Tex-Sol Explorations Limited in the "Economic Geology" section. Possible modes of formation are discussed in the subsection on iron in the "Economic Geology" section. Photomicrographs 8 and 9 are of the magnetite-rich and the chert-rich bands, respectively (Photos 8 and 9).

Macroscopically the magnetite ironstone beds are 3 to 5 cm thick, interbedded with recrystallized chert and wacke beds 4 to 6 cm thick. The rock is dark to medium grey and weathers brownish. The ironstone is composed of 35 percent magnetite, 15 percent hematite, 40 percent quartz or recrystallized chert, 5 percent hornblende, and 5 percent grunerite. The chert beds contain 10 to 15 percent iron minerals.

Photo 8. ***Photomicrograph of magnetite-rich band of the magnetite-bearing chert interbedded with magnetite ironstone from the Tex-Sol Explorations Limited property on Kesaka Lake. Light mineral = magnetite; bladed medium grey mineral = grunerite (arrow); dark grey mineral = quartz.***

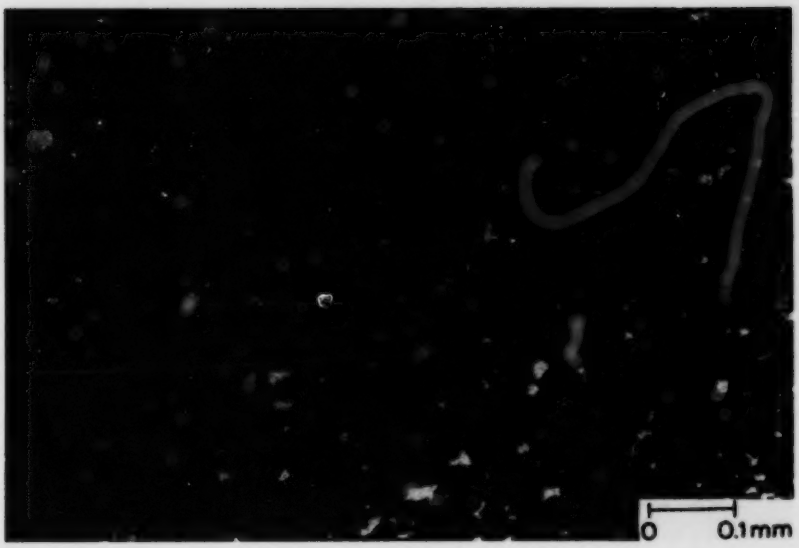


Photo 9. *Photomicrograph of chert-rich band of the magnetite-bearing chert interbedded with magnetite ironstone from the Tex-Sol Explorations Limited property on Kezaka Lake. Light grains = magnetite; light and dark grey = recrystallized chert.*

Chert and magnetite appear to have formed contemporaneously with hematite forming later as did hornblende and grunerite. Secondary quartz occurs as veinlets cutting both the chert and magnetite ironstone beds.

Lower grade ironstones occur west of West Badrock Lake and north and south of the Papaonga River between West Badrock Lake and Badrock Lake. Most of these ironstones are delineated by aeromagnetic and ground magnetic surveys (El Sol Gold Mines, 1957 in Assessment Files Research Office, Ontario Geological Survey, Toronto), but some drilling was done on the zone west of West Badrock Lake confirming the presence of magnetite ironstone. No drilling was done on the several airborne and ground magnetic anomalies located on either side of the Papaonga River between Badrock and West Badrock Lake. Exposure is poor, but several 1.5 to 2 m channel samples taken by the author and analyzed have from 16 to 37 percent Fe (Geoscience Laboratories, Ontario Geological Survey, Toronto).

In the northwestern part of the map area southeast of Neepawa Bay an airborne magnetic anomaly (Ontario Department of Mines–Geological Survey of Canada 1960a) is produced by a magnetite ironstone chert formation 2 to 6 m wide that is present in several outcrops.

An iron formation roughly 60 m wide and 2 km long is present north of Tepeka Lake. This unit consists of magnetitic jasper interbedded with magnetite ironstone. A channel sample, taken by the field party and analyzed (Geoscience Laboratories, Ontario Geological Survey, Toronto) contained 36.7 percent Fe. In thin section a considerable amount of reddish black opaque material was noted in the jasper-rich parts. The magnetite ironstone beds contained 60 to 65 percent magnetite. Hematite probably does not exceed 5 to 10 percent. The hematite is

in the form of specularite and occurs as thin plates or laths. Beds range in thickness from somewhat less than 0.5 cm to just over 1 cm. Drag folding of the beds is common. Photomicrographs 10 and 11 are of the magnetitic jasper and the jasper-rich bands, respectively (Photos 10 and 11).

Pyritic ironstone occurs in zones large enough to map on the north and south shores of Slate Lake and on the north shore of Wassa Bay. The pyrite is nearly always associated with chert. Generally, the sulphide ironstone occurs as 2 to 10 m long pods not over 30 cm wide, and may occur as nodules or as thin beds within the chert beds. In the metasediments along the north shore of Slate Lake some magnetite ironstone is associated with the sulphide ironstone.

MAFIC TO INTERMEDIATE INTRUSIVE ROCKS

Mafic to intermediate intrusive rocks occur as a discrete diorite stock (Tepeka Lake Stock), and as dikes and sills intruding most other rock types in the area. Some of the mafic intrusive phases in the northwestern part of the area may be coarser grained parts of thick mafic metavolcanic flow units. Mafic intrusive rocks make up about 5 percent of the rocks in the map area.

Tepeka Lake Stock

The Tepeka Lake Stock is a small, oval-shaped, mafic to intermediate intrusive body. It is located just south of Tepeka Lake and is approximately 2.5 km^2 in area. It has a positive topographical expression standing 30 to 40 m above the surrounding terrain. It is composed of fine- to medium-grained, foliated, dark grey rock which weathers greyish brown to brownish green. Clots of mafic minerals up to 4 mm, which appear to be largely biotite, occur fairly commonly. Some epidote alteration and quartz veining on a small scale are common.

Petrographically the rock is fine to medium grained with plagioclase grains less than 1 mm and clots of amphibole up to 2 to 3 mm. Biotite grains rarely exceed 1 mm. Plagioclase constitutes about 50 percent of the rock and some grains exhibit zoning with An content varying from 26 to 32. The remainder comprises: hornblende 10 to 15 percent, biotite 15 to 20 percent, epidote 5 to 7 percent, apatite 1 to 3 percent, euhedral magnetite 5 to 7 percent, and variable amounts of chlorite and zircon. Some fine (less than 1 mm) quartz veinlets cut the rock. The rock is classified as a diorite. Figure 2 is a plot of the modal mineralogy of plutonic rocks from the Slate Lake area according to Streckeisen's (1976, p.8) classification.

Mafic Dikes and Sills

Numerous mafic dikes and sills were encountered in the map area. Many are very small, on the order of 20 to 30 cm wide; many cut the metavolcanics and metasediments and are too small to be shown on the map. Narrow (1 cm) chill margins are common, xenoliths were rarely observed, and the dikes and sills generally weather 0.5 to 1 cm below the more resistant host rock. Rock colour varies from dark green to greenish black on fresh surfaces and dull greenish grey to greenish black on weathered surfaces. The mafic colour index of these rocks ranges from 30 to over 60.

A typical dike rock is composed of 25 to 50 percent plagioclase An_{28-38}, 30 to 40 percent hornblende, with biotite ranging from 5 to 30 percent. Accessory minerals are magnetite, pyrite, apatite, sericite, and epidote. A small dike of epidote-rich gabbro on the western shore of West Badrock Lake contains 15 to 20 percent epidote, no plagioclase, less than 10 percent quartz, 35 to 40 percent hornblende, 20 to 25 percent chlorite, and about 10 percent of magnetite, ilmenite, leucoxene, sphene, and apatite combined.

An epidote-rich quartz gabbro sheet intrudes the conglomerate unit at Sawan Bay and extends about 7.5 km eastward to just south of Maskooch Lake where it

Photo 10. *Photomicrograph of magnetitic jasper interbedded with magnetite ironstone from Tepeka Lake. Light = magnetite; grey = jasper; black = plucked jasper or unpolished surface.*

Photo 11. *Photomicrograph of jasper-rich band of magnetite-bearing jasper interbedded with magnetite ironstone from Tepeka Lake. Light = Magnetite; grey = jasper; black = plucked jasper or unpolished surface.*

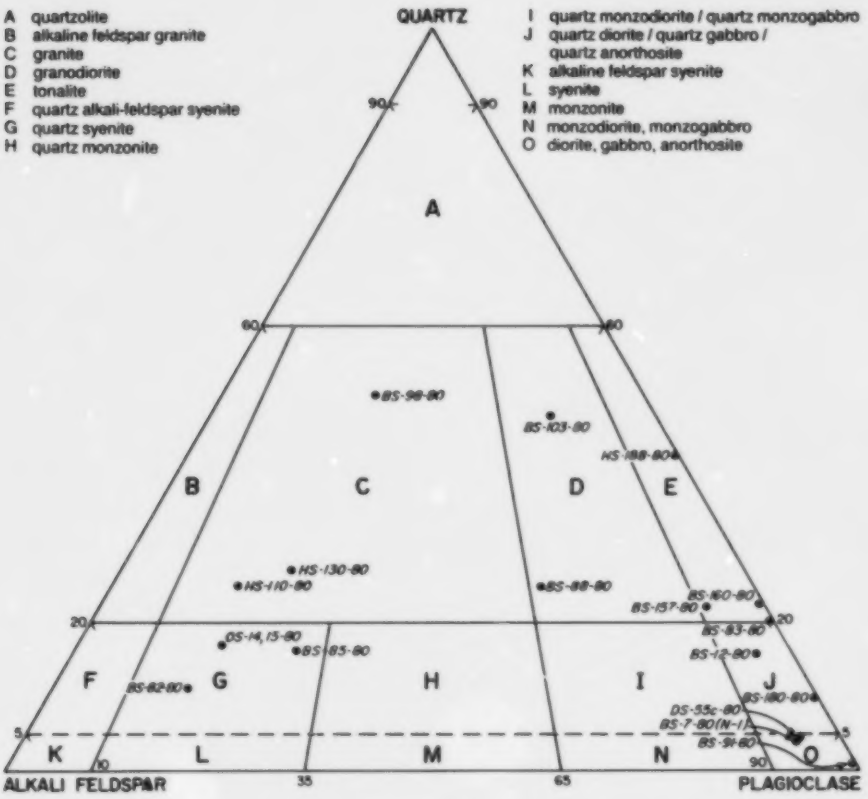


Figure 2. *Classification of plutonic rocks in the Slate Lake Area after Streckeisen (1976, Figure 1a, p.8).*

also cuts intermediate metavolcanics. This sheet is on the average 100 to 200 m thick but reaches a maximum of 400 m about 2.5 km from its western extremity.

The northwestern part of the map area is underlain by the Uchi Lake series of mafic metavolcanics (Bateman 1940), the Cycle I flows of Thurston (1978), that are intruded by dioritic to ultramafic sheets. Contacts between these intrusive rocks and surrounding rock types were not observed. Minor alignment of amphibole phenocrysts is the only indication of foliation.

These rocks are generally dark greenish grey to greenish black and weather greenish grey to black. Amphibole pheoncrysts are on the order of 1 to 2 mm subhedral grains. Their primary shape is preserved through greenschist facies metamorphism, however, at albite-epidote facies chlorite begins to replace the amphibole and in so doing the amphibole form is obliterated. Feldspar is largely absent. The sills in this area are composed of quartz in amounts up to 20 to 25 percent, amphibole from 30 to 40 percent, biotite from 10 to 45 percent, chlorite from 10 to 15 percent, and accessory iron-titanium oxides and epidote. The feldspar appears to have been replaced by tightly packed anhedral quartz grains with lesser amounts of epidote and amphibole (hornblende and acicular actinolite).

Several small, 10 to 30 cm wide lamprophyre dikes cut the intermediate metavolcanic sequence on the north shore of Upper Slate Lake. The rock con-

tains 25 to 30 percent biotite and 10 to 15 percent sericite with 1 to 3 percent magnetite and pyrite and 10 to 15 percent carbonate. The carbonate and sericite are alteration products with carbonate cutting the original minerals and crystallizing along mineral planes. Sericite is an alteration product of plagioclase and can be seen replacing the plagioclase. Plagioclase occurs in phenocrysts, 15 to 20 percent, 0.1 to 0.15 mm in size and in the groundmass, 10 to 15 percent, less than 0.1 mm in size. An content varies from 30 to 37. The rock is highly foliated to schistose and biotite occurs in discontinuous stringers. Plagioclase phenocrysts partially, or wholly enclose biotite laths.

FELSIC TO INTERMEDIATE SUBVOLCANIC ROCKS

These rocks comprise roughly 5 percent of the map area and consist of porphyritic dikes, sills, stocks, and transition rims of larger intrusive bodies.

Feldspar and Quartz-Feldspar Porphyry Dikes and Sills

Feldspar and quartz-feldspar porphyry dikes and sills are prominent northeast of West Badrock Lake associated with ironstone and felsic metavolcanic contacts in that area. These porphyries are either associated with the metavolcanic unit, or are derived from the West Badrock Lake Pluton. Smaller dikes are found intruding metasediments on Badrock Lake. Another prominent porphyritic unit is found in contact with the southwestern nose of the Papaonga Lake Pluton and appears to be derived directly from it possibly as a cooling margin or chill phenomena.

Feldspar Porphyry of West Badrock Lake

This rock type appears to intrude or to be emplaced between the wacke to the south, which appears to be the younger unit (tops determined from graded bedding, crossbedding, and flame structures), and the magnetitic chert-magnetite ironstone formation. The ironstone overlies felsic metavolcanics.

Petrographically the feldspar porphyry has a groundmass containing 35 to 40 percent quartz in anhedral interlocking crystals 0.1 mm, but commonly separated by or surrounded by interstitial biotite (15 to 20 percent of the rock), and interlocking with similar size anhedral plagioclase crystals or fragments. The plagioclase is An_{6-8} and comprises 5 to 10 percent of the matrix. This aphanitic groundmass exhibits a trachytic texture with 1 to 2 mm phenocrysts of K-feldspar which make up approximately 40 percent of the rock. Fine laths of biotite and sericite are noted within the phenocrysts. Some quartz inclusions are also noted. These rocks are granitic to granodioritic in composition.

Feldspar Porphyry of Badrock Lake

The sills and dikes of feldspar porphyry are not as extensive as those closer to the West Badrock Lake Pluton. Some are only 10 to 20 cm wide and none were found exceeding 1 m wide. Petrographically the porphyry is made up of 2 to 3 mm phenocrysts of K-feldspar and plagioclase An_{23-32} in an aphanitic matrix of quartz 30 to 40 percent and muscovite, sericite, and kaolinite 15 to 20 percent, as alteration products including minor amounts of carbonate and chlorite.

The dikes are well foliated and commonly exhibit shearing. The phenocrysts generally have an augen-like shape. The groundmass is trachytic. In some dikes the mica is biotite, in others it is muscovite. Muscovite appears to be more prevalent near the felsic metavolcanic unit north of the Papaonga River system whereas biotite is more prevalent in dikes intruding the wacke. In one dike small (0.1 mm) garnets were noted within 1 mm of the contact with the wacke. Garnets are common in the wacke unit itself. Carbonate and chlorite alteration were noted in thin section. Quartz is confined to the groundmass. These dikes vary in composition from granite to granodiorite.

Feldspar Porphyry Rim of the Papaonga Lake Pluton

The rock unit mantling the Papaonga Lake Pluton, around the southwestern tip, is a feldspar porphyry of intermediate composition. The rock ranges in colour from pinkish white to dark grey and weathers to brownish grey. The Papaonga Lake Pluton has a 50 to 80 m relief above the surrounding terrain.

Petrographically the rock is composed of 30 to 60 percent plagioclase, An_{24-30}, subhedral to euhedral phenocrysts 1 to 3 mm long by 0.25 to 1 mm wide in an aphanitic groundmass composed of biotite (20 to 25 percent), quartz (25 to 30 percent), and less than 5 percent of epidote, sericite, chlorite, and magnetite. The quartz appears recrystallized and is anhedral and the biotite laths are not well developed. The groundmass has a trachytic texture around the phenocrysts indicating flow. Accessory minerals are subhedral to euhedral. In Streckeisen's (1976) classification the unit is considered a tonalite.

Several other smaller outcrops of feldspar porphyry were noted intruding metasediments and either intruding, or closely related to felsic metavolcanic tuff and thick parts of flows.

Maskooch Lake Stock

The Maskooch Lake intrusion is a feldspar to quartz-feldspar porphyry with subhedral to anhedral quartz and feldspar phenocrysts measuring 0.5 to 1 mm on the average with 4 mm the maximum, in length, in a dark to medium grey aphanitic groundmass. The intrusion is approximately 2.5 km² in areal extent. Quartz comprises 15 to 20 percent of the rock, commonly as blue quartz eyes. K-spar ranges from 10 to 50 percent and plagioclase 40 to 60 percent. Total feldspar ranges from 50 to 80 percent. Biotite and hornblende comprise 7 to 15 percent and 1 to 5 percent respectively, not exceeding 25 percent in any location and appear as phenocrysts 0.25 to 0.5 mm. Pyrite is common as 0.25 mm by 1 to 3 cm stringers. Up to 0.5 percent magnetite is present in microscopic size crystals. Mafic colour index is 15 to over 30. The rock weathers brownish grey probably due to oxidization of the iron sulphides and oxides. Plotting mineral content on Streckeisen's (1976) diagram shows this rock to be granitic in composition.

This unit intrudes a felsic metavolcanic sequence and appears to conform to the regional foliation which is mostly eastward with a steep dip to the south. Ground magnetometer and horizontal loop anomalies delineated by St. Joseph Exploration Limited (10) conform to the contact between the intrusive and the metavolcanic sequence. This may be explained by sulphide concentrations in the contact zone.

One sample from the contact contains 0.5 to 2.5 mm greenish laths in a quartz and sericite matrix. In thin section these laths are poikiloblastic twinned chloritoid. Chloritoid makes up 7 to 10 percent of the rock with the rest composed of 40 percent quartz, 40 to 45 percent sericite, and 2 to 3 percent Fe-Ti oxides. The presence of chloritoid in the contact zone indicates hydrothermal alteration.

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Felsic to intermediate intrusive rocks comprise roughly 10 percent of the map area and are in the form of plutons (2.5 km² or greater in area) to larger batholithic complexes.

West Badrock Lake Pluton

The West Badrock Lake Pluton, a granodiorite, oval in shape with its long axis trending at roughly azimuth 60 degrees, is approximately 20 km² in areal extent.

This pluton consists of medium to light grey, medium- to coarse-grained rock (1 to 3 mm) composed of anhedral to subhedral interlocking grains of quartz,

potassic feldspar, plagioclase, hornblende, biotite, epidote, clinozoisite, and minor magnetite. Near the pluton's western contact, the rock is a quartz syenite with potassic feldspar phenocrysts 5 to 7 mm long by 2 to 5 mm wide. Within the pluton, foliation trends N60E and, near the contacts, the foliation tends to conform to the contact.

Thin section examination indicates that the quartz content of the pluton ranges from 10 to 15 percent; the potassic feldspar ranges from 10 percent in the centre to 40 percent near the contacts; the plagioclase, An_{18-33}, ranges from 20 to 30 percent in the centre to 10 to 15 percent near the contacts; biotite averages 15 to 20 percent, and hornblende ranges from 10 percent near the contacts to 1 percent near the centre. Near the centre of the pluton, actinolite is present and may have replaced hornblende. Epidote, clinozoisite, and allanite range from 1 to 5 percent. Allanite is commonly found as a core surrounded by epidote or clinozoisite. Apatite content ranges from 1 to 3 percent and opaque minerals are not common.

Granophyric and myrmekitic textures were noted in samples from near contacts, but are rare toward the centre of the pluton. Chill margins are near the contact and xenoliths are rare. Breccia zones are well developed along the intrusive contact with the metasediments. Mafic colour index of the rocks in the pluton ranges from 20 to 30. A sample near the centre of the pluton was analyzed and the results are tabulated in Table 4.

Wassa Bay Pluton

The Wassa Bay Pluton is composed of quartz syenite, is oval in shape, and is approximately 6.4 km^2 in areal extent. Foliation trends roughly N60E, conformable to the foliation of the surrounding rocks.

The rock is coarse grained with K-spar grains ranging in size from 3 to 5 mm. Mafic minerals, plagioclase, and quartz grains are generally less than 2 mm and are subhedral to euhedral. The typical rock is an orange-pink on fresh surface and weathers a light grey-orange. Some parts appear to have undergone hydrothermal alteration, because of the feldspar and mafic minerals, and appear dull in colour, or have lighter coloured rims along mineral boundaries. Quartz comprises less than 10 percent of the rock with microcline 15 to 20 percent and orthoclase 30 to 40 percent. Microcline and orthoclase commonly appear as intergrowths, generally microcline in orthoclase. Granophyric texture is common especially where the quartz content is greater than 10 percent. Plagioclase composes 15 to 20 percent of the rock with An content 26 to 30. Mafic minerals are rare and do not exceed 5 to 7 percent of the rock. Biotite is the most common being 1 to 3 percent of the rock with hornblende exceedingly rare and generally less than 0.5 to 1 percent. Well-developed sphene, magnetite, and apatite are present. Actinolite was observed in a veinlet in one sample and zircon was noted in the centres of haloes in biotite.

Quartz and mafic mineral content appear to be somewhat higher in the southwestern part of the pluton and alteration appears more pronounced in the northwestern part. Mafic colour index ranges from 5 to 10. Contacts with the surrounding rock types were not found, however, adjacent to the interpreted contact with felsic metavolcanics at the southern margin fine-grained aplites were noted. These aplites occur as dikes and as alteration radiating 3 to 5 cm outward from fractures in the rock. The large exposure in the northeastern part of the pluton extending some 60 m above the surrounding terrain has similar phenomena.

The chemical analysis of a sample taken from the southeastern rim of the pluton is in Table 4.

TABLE 4.. WHOLE ROCK GEOCHEMICAL ANALYSES FROM 20 SAMPLES FROM THE SLATE LAKE AREA. (Samples located on Figure 3).

Sample No.	1	2	3	4	5*	6*	7*	8*	9*	10*
SiO_2	52.0	55.7	48.8	42.9	64.3	67.1	45.4	59.8	61.5	59.2
Al_2O_3	14.0	15.3	13.2	12.6	19.4	17.8	11.1	15.6	19.4	32.3
Fe_2O_3[1]	13.40	8.93	17.70	13.10	2.09	2.14	14.40	6.12	7.91	0.00
MgO	2.20	1.94	2.36	3.17	1.40	0.67	2.83	2.34	2.83	0.19
CaO	6.27	5.04	5.23	11.20	4.33	1.18	9.49	4.33	1.38	0.43
Na_2O	2.80	1.61	0.55	2.34	4.73	5.24	3.26	1.86	1.97	1.89
K_2O	0.43	1.28	0.75	0.50	2.21	5.10	0.05	0.85	3.07	2.34
TiO_2	1.72	0.73	0.66	1.49	0.29	0.29	1.28	0.69	0.62	1.00
P_2O_5	0.22	0.24	0.26	0.13	0.10	0.12	0.13	0.17	0.12	0.04
MnO	0.40	0.27	0.74	0.38	0.03	0.05	0.49	0.10	0.06	0.00
CO_2	4.89	7.20	7.33	10.40	0.27	0.21	11.50	6.38	0.72	0.13
S	0.06	0.09	0.15	0.01	0.01	0.01	0.02	0.01	0.02	0.01
L.O.I.	6.9	9.0	9.2	11.7	0.8	0.8	11.5	8.0	1.3	2.6
Total	100.3	100.0	99.4	99.5	99.7	100.4	99.9	99.8	100.1	100.0
S.G.	2.82	2.78	2.85	2.81	2.69	2.64	2.91	2.80	2.77	2.84
Ba	250	550	450	350	800	790	60	250	590	360
Co	42	19	32	48	7	-5	31	18	16	31
Cr	194	61	56	54	32	7	44	72	144	24
Cu	64	22	33	38	5	6	40	26	12	14
Li	10	34	34	26	28	68	7	38	48	17
Ni	124	29	65	51	20	5	39	39	42	25
Pb	-10	49	69	32	14	44	-10	-10	13	10
Zn	130	73	78	125	36	59	88	91	90	12
Mo	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
Sr	165	170	290	110	170	150	230	285	205	270
V	270	130	90	370	45	30	280	90	135	160
Y	17	16	18	13	5	13	14	10	9	11
Zr	50	165	130	55	65	255	50	140	120	240

*1. Tholeiitic basalt 2. Tholeiitic andesite 3. Tholeiitic basalt 4. Tholeiitic basalt 5. Granodiorite 6. Quartz Syenite 7. Tholeiitic basalt 8. Calc-alkalic andesite-dacite 9. Metatexite 10. Metapelite [1]Fe_2O_3 expressed as total iron. *Thin section available Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.*

Papaonga Lake Pluton

The Papaonga Lake Pluton is oval in shape with its long axis oriented N70E. Only the western half of the pluton (13 km^2) lies within the map area.

Along the southern contact, north of the Papaonga River, a porphyritic zone roughly 100 m wide compositionally almost identical to the pluton is found. The porphyritic zone is slightly more quartz-rich, the An content of the plagioclase is slightly higher, and hornblende is absent in thin section. Using Streckeisen's (1976) classification both the porphyritic zone and the main body of the pluton fall within the tonalite zone.

In hand specimen, the plutonic part is moderately well foliated with a salt-and-pepper appearance, medium to pinkish grey and weathering to dull, light grey to brownish grey. Clots of biotite-rich material occur throughout which suggests a mixing phenomenon as the cause of their formation (Eichelberger 1975) (Photo 12). As the pluton is about 4 km in diameter and wacke-like metasediments are in contact to the west and north with only a thin unit of mafic metavol-

TABLE 4. CONTINUED.

Sample No.	11*	12*	13*	14*	15*	16	17*	18*	19*	20*
SiO_2	56.0	58.0	67.8	61.5	61.4	64.5	45.8	64.3	72.5	49.8
Al_2O_3	22.1	26.8	14.8	17.8	17.2	16.7	14.5	17.1	17.6	16.0
Fe_2O_3[1]	3.20	0.65	5.78	4.94	4.39	6.53	23.10	4.44	0.26	13.00
MgO	1.63	0.59	2.56	1.13	3.62	2.76	5.01	1.17	0.25	6.72
CaO	3.59	3.41	1.98	2.90	4.05	2.36	5.95	1.47	0.59	9.66
Na_2O	7.19	3.73	2.50	4.37	3.34	2.61	0.85	5.44	4.35	2.91
K_2O	2.48	3.90	1.59	1.87	3.91	1.91	0.48	1.89	3.40	0.18
TiO_2	0.21	0.50	0.60	0.63	0.50	0.64	1.52	0.53	0.04	0.97
P_2O_5	0.14	0.10	0.12	0.12	0.17	0.13	0.15	0.09	0.11	0.07
MnO	0.04	0.02	0.08	0.08	0.06	0.09	0.69	0.05	0.01	0.19
CO_2	2.38	0.38	0.15	4.27	0.27	0.45	0.69	1.93	0.46	0.19
S	0.00	0.01	0.10	0.02	0.01	0.25	0.04	0.01	0.01	0.01
L.O.I.	3.6	2.4	2.0	5.3	0.9	2.3	0.4	2.9	1.1	0.7
Total	100.1	100.1	99.8	100.6	99.8	100.5	98.5	99.4	100.2	100.2
S.G.	2.63	2.71	2,70	2.75	2.73	2.74	3.08	2.67	2.61	3.02
Ba	520	420	420	420	760	480	180	480	130	110
Co	10	-5	19	10	16	21	31	8	-5	45
Cr	73	16	120	18	173	138	94	13	-5	227
Cu	6	-5	35	8	32	49	108	12	-5	26
Li	20	7	30	11	33	34	22	20	24	12
Ni	32	8	55	20	59	62	29	16	-5	108
Pb	15	13	43	-10	23	11	-10	-10	24	-10
Zn	36	27	92	56	54	88	150	62	18	110
Mo	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
Sr	255	290	250	245	300	310	75	305	55	185
V	65	35	110	70	100	130	285	65	3	330
Y	9	6	10	9	12	14	24	7	3	24
Zr	70	110	125	135	100	145	55	100	40	16

*11. Granodiorite feldspar porphyry-alkalic affinity 12. Calc-alkalic dacite-rhyolite 13. Calc-alkalic dacite-rhyolite 14. Tholeiitic-rhyolite-dacite 15. Tonalite 16. Calc-alkalic rhyolite-dacite-andesite 17. Tholeiitic-basalt 18. Calc-alkalic dacite 19. Homogeneous diatexite 20. Tholeiitic basalt Cycle I Metavolcanics after Thurston(1978) [1]Fe_2O_3 expressed as total iron. *Thin section available Analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.*

canics along the south contact, it would seem unlikely that these clots are xenoliths. Most of the clots are oval to teardrop in shape 3 to 5 cm wide by 10 cm long although some attain a length of over 30 cm and their long axis is aligned parallel to the foliation trend. Biotite and hornblende with minor chlorite comprise over 60 percent of the clots with plagioclase and quartz making up the balance. Accessories such as magnetite, pyrite, sphene, zircon, apatite, and leucoxene are present in minute quantities. Resorption of feldspar phenocrysts is common. Plagioclase is the matrix for the biotite and hornblende of the clots, and grain size decreases from the centre toward the rim.

Petrographically the Papaonga Lake Pluton is inequigranular, holocrystalline, subidiomorphic with 0.5 to 3 mm crystals of 10 to 15 percent quartz, 40 to 50 percent plagioclase An_{22-30}, 15 to 20 percent hornblende, and 5 to 10 percent biotite. Orthoclase was noted in one thin section, but did not exceed 5 percent. Some pyroxene, possibly augite, was also noted although it was being replaced by hornblende. Minute quantities of small crystals of apatite, zircon, epidote, mag-

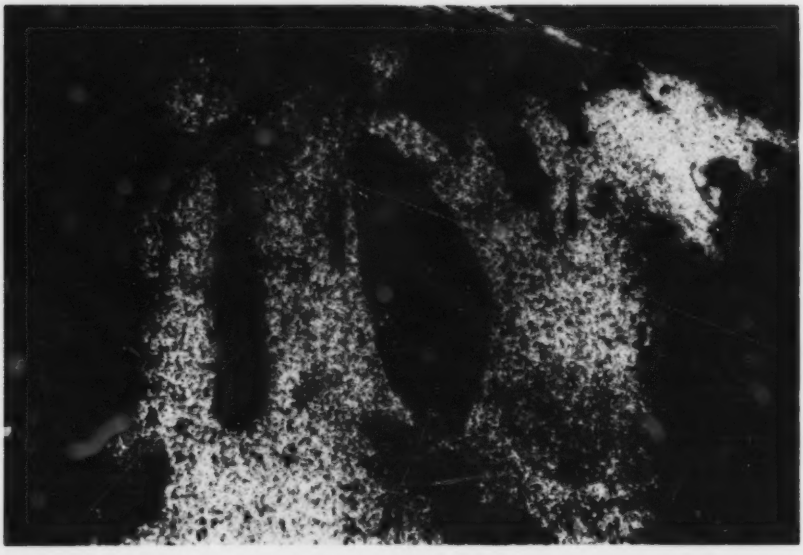


Photo 12. *Biotite-rich clots in tonalite of the Papaonga Lake Pluton. (Hammer is 36 cm long).*

netite, and sericite were noted. Plagioclase is commonly zoned and mildly sericitized.

The porphyritic part of the pluton is described under the heading "Feldspar and Quartz-Feldspar Porphyry Dikes and Sills". Table 4 tabulates the petrochemistry of the pluton.

Jeanette Lake Batholith

The Jubilee Lake part of the Jeanette Lake Batholith (Allison Lake Batholith of Thurston 1978) cuts into the northeastern corner of the map area.

The rock is a medium-grained (1 to 3 mm), holocrystalline, inequigranular (mafic minerals 0.25 to 0.5 mm), granite and varies from light pinkish grey to orangish pink on fresh surface weathering to light grey to orangish grey.

Petrographically the rock contains subhedral to anhedral 20 to 25 percent quartz, 50 to 60 percent K-spar (roughly 3 to 5 percent microcline and 50 to 55 percent orthoclase), 10 to 15 percent plagioclase An_{20-25}, and 3 to 5 percent biotite and muscovite. Hornblende in amounts of 1 percent is present and there are minor amounts of accessory minerals apatite, zircon, clinozoisite, and epidote. Local pegmatite zones (crystals 3 cm) are present, especially where the unit intrudes adjacent wacke metasediments. Muscovite is common (>5 percent) and garnet up to 5 mm were noted in the pegmatite. Contacts between the pegmatite and batholith phases are gradational. The pegmatite occurs most commonly as dikes or sills in the metasediments. Some sills and dikes have feldspar crystals up to 15 cm long, books of muscovite up to 4 cm maximum dimension, and abundant quartz. These sills and dikes are 2 to 3 m wide and were traced across one island in Jubilee Lake for 100 m.

These rocks fall in the granitic classification petrographically (Streckeisen 1976).

PETROCHEMISTRY

Twenty samples were selected for major component and trace element analysis. These analyses were performed by the Geoscience Laboratories, Ontario Geological Survey, Toronto, and the results are tabulated in Table 4. Figure 3 shows sample locations. Triangles with element symbols designate location of analysis samples. Dark circles designate thin section sample locations. Hexagon symbol with sample number locates whole rock analyses.

All rock types are classified by the method of Irving and Baragar (1971). All are subalkalic except sample 11 which is a granodiorite feldspar porphyry with alkalic affinity.

In order to further categorize the rock types the values for cation percentages of (1) Al_2O_3, (2) FeO plus Fe_2O_3 plus TiO_2, and (3) MgO as parameters are plotted on a ternary diagram (Figure 4) devised by Jensen (1976). This diagram classifies samples as calc-alkalic or tholeiitic and further breaks the relative fields into rhyolite, dacite, andesite, and basalt. The diagram also separates the tholeiitic basalts into iron-rich and magnesia-rich types based on the ratio FeO plus Fe_2O_3 plus TiO_2 to MgO. There were no komatiitic rocks noted, so that part of the diagram is not labelled.

Cycle I metavolcanics make up the base of the metavolcanic sequence. The lowermost units are magnesian tholeiitic basalts which are more iron-rich higher in the sequence. A standard AFM diagram plot with the dashed line determined by Irving and Baragar (1971) dividing tholeiitic (toward the F apex) and calc-alkalic series rocks (toward the A apex) is shown in Figure 5. Figures 4 and 5 categorize samples 1, 2, 3, 4, 7, 17, and 20 as tholeiitic.

Higher in the sequence, calc-alkalic intermediate and felsic pyroclastic rocks of a tuffaceous to lapilli-tuff nature, some water-laid, become dominant (samples 8, 12, 13, 14, 16, and 18). Sample 9, a metatexite derived from a wacke, sample 10, a metapelite, and sample 19, a homogeneous diatexite, plot in the calc-alkalic field on both the Jensen and AFM diagrams. These three samples are metasediments. All the plutonic rocks, samples 5, 6, and 15, plot in the calc-alkalic field of both Figures 4 and 5.

The alkali-silica plot lends itself to distinguishing between alkalic and subalkalic rocks. The line providing the division is after Macdonald (1968). Figure 6, an alkali-silica plot, demonstrates that, except for sample 11, all other samples are subalkalic. This plot does not easily facilitate distinguishing between calc-alkalic and tholeiitic rocks, however.

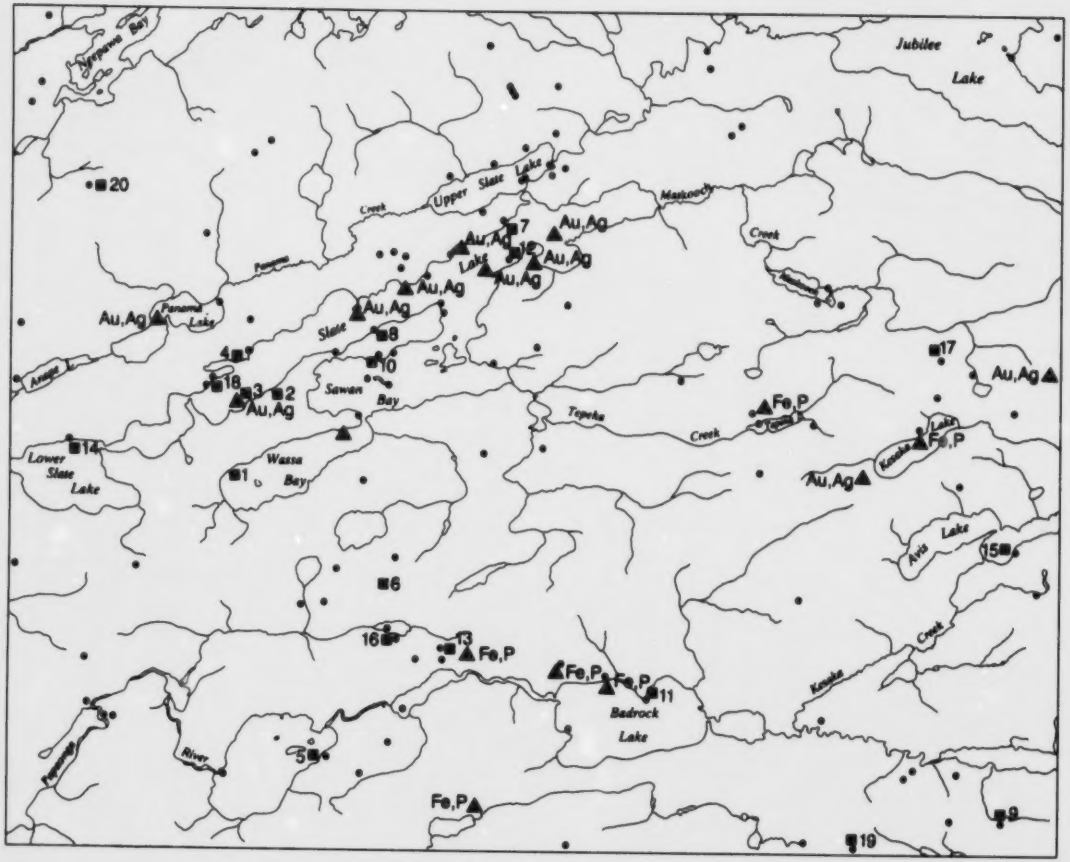
On normative An-Ab-Or diagram, Figure 7, which separates K-poor, common, and K-rich variants, it is observed that most of the rocks fall in the "average" designation.

An AKM diagram, Figure 8, groups all the samples in the A apex indicating that the rocks are alkali and magnesium poor.

METAMORPHISM

The metavolcanic-metasedimentary sequence has been subjected to regional dynamothermal metamorphism. The felsic and mafic plutons have not undergone any significant metamorphic alteration. The mafic dikes intruding the metavolcanic sequence appear to be related to volcanism and in thin section appear to have undergone extensive recrystallization indicating metamorphism.

Metamorphic grade near contacts of the plutons is mainly albite-epidote-hornfels facies with some hornblende-hornfels grade in some limited areas. Metamorphic grade for most of this metavolcanic and metasedimentary sequence ranges from low greenschist to middle cordierite-amphibolite facies of the low pressure Abukuma-type metamorphism (Winkler 1967). Anatexis of metasedi-



- Thin section / polish section
- ■ Whole rock analysis with number, see Table 4
- ▲ Analysis / assay (Fe, P, Au, Ag)

Figure 3. *Sample location map for the Slate Lake Area.*

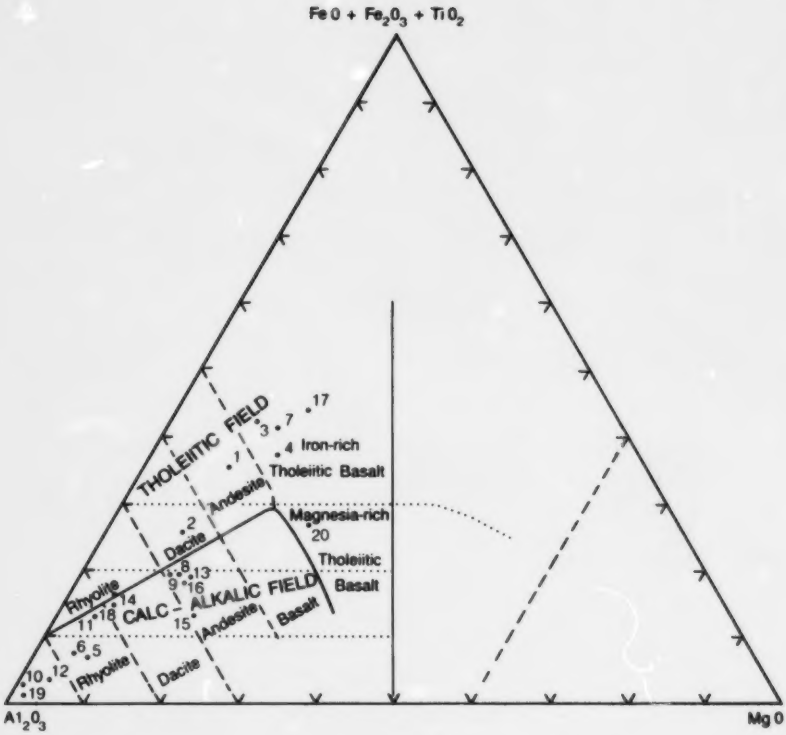


Figure 4. *Plot of 20 metavolcanic samples on Jensen Cation Diagram.*

ments has occurred in the southernmost part of the map area south of the Papaonga River resulting in a metatexite consisting of a wacke paleosome, generally with sillimanite, garnet, and andalusite, and with 0 to 10 percent interbanded granitoid mobilizate with primary bedding preserved grading to increasingly higher percentages of homogeneous diatexite. This latter rock can best be described as an over 70 percent medium-grained to pegmatitic granitoid mobilizate with primary bedding not preserved (Mehnert 1971) (*see* Figures 9 and 10).

Regional Metamorphism

Metamorphic grade of the rocks in the map area increases in a southward direction. The andalusite-cordierite-muscovite subfacies mineral assemblages (Winkler 1967) were first noted along the north shore of Sawan Bay. Rocks north of this area appear to contain only minerals associated with greenschist facies metamorphism although almandine garnet was noted south of the Birkett Township boundary along the Wenasaga River and in the mafic metavolcanic pile north of Kesaka Lake. No kyanite was noted but andalusite is relatively common, placing the regionally metamorphosed rocks in the Abukuma-type facies (Winkler 1967).

Andalusite, muscovite, and almandine become progressively more common south of Slate Lake and sillimanite was noted south of the Papaonga River. This observation places the rocks between Slate Lake and the Papaonga River in the andalusite-cordierite-muscovite subfacies and the rocks south of the Papaonga River in the sillimanite-cordierite-muscovite subfacies of cordierite-amphibolite facies metamorphic grade (Winkler 1967). Staurolite was noted as 0.5 to 1 cm

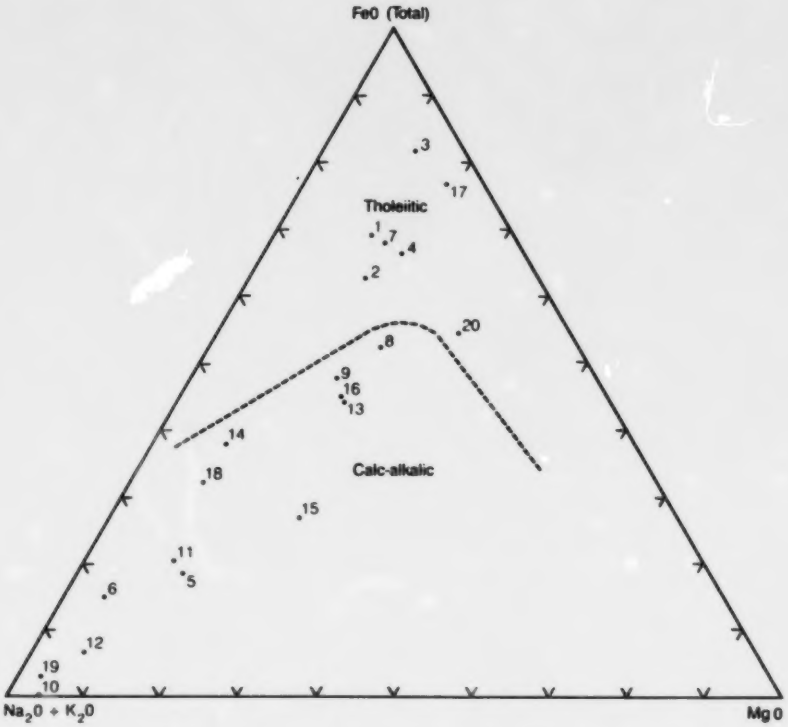


Figure 5. *Plot of 20 samples on AFM diagram showing separation of tholeiitic and calc-alkalic suites.*

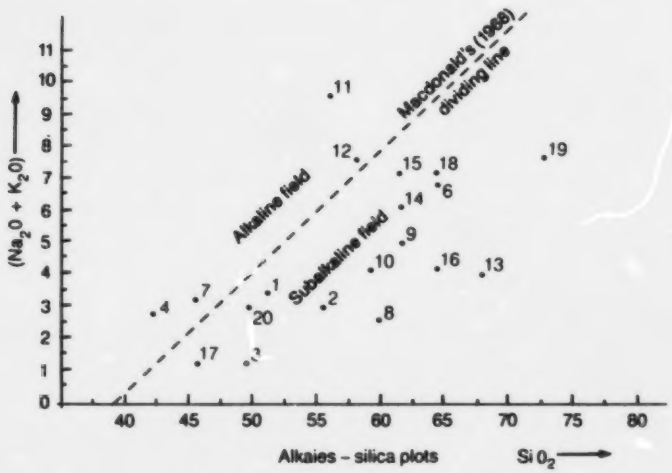


Figure 6. *($Na_2O + K_2O$) versus SiO_2 plot for 20 samples.*

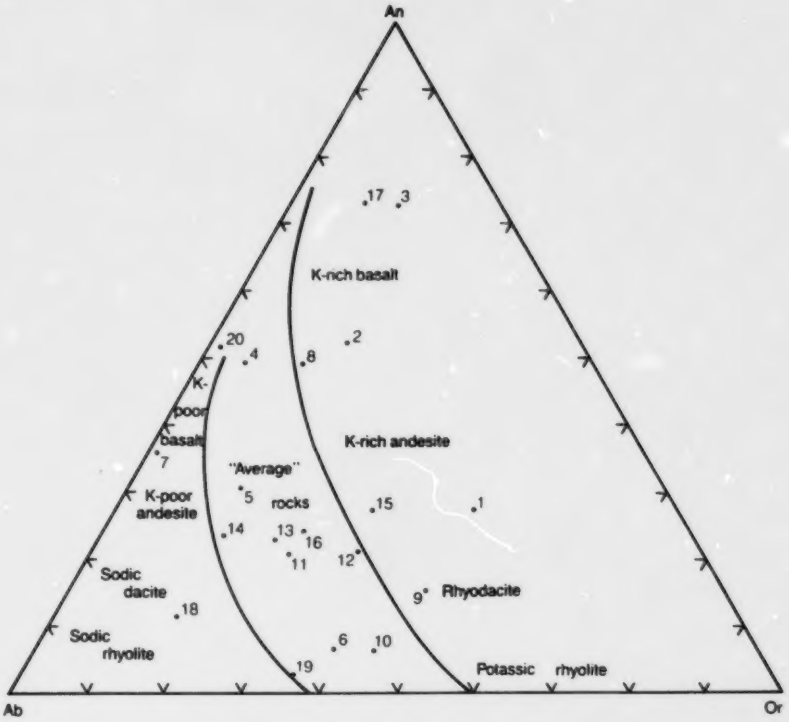


Figure 7. *Ab-An-Or plot for 20 samples using CIPW normative calculations.*

porphyroblasts in subarkosic wacke and mudstone along the eastern contact with the West Badrock Lake Pluton (*see* Figure 11).

Metamorphism predated emplacement of felsic to intermediate plutons but postdated emplacement of mafic dikes based upon the degree of alteration and the amount of metamorphic minerals associated with these dikes. Metamorphism is noted in all rocks of metavolcanic and metasedimentary origin with metamorphic grade increasing to the south suggesting that a metamorphic maximum is located in the vicinity of the Bluffy Lake Batholith complex south of the map area.

CENOZOIC

QUATERNARY

Pleistocene and Recent

The Pleistocene and Recent geological deposits are essentially glacial derived debris and organic deposits. The part of the map area north of 51°N Latitude was included in a regional Pleistocene mapping project undertaken by Prest (1963). The following discussion will follow his descriptions and terminology.

There are bedrock outcrops sporadically through a relatively thin mantle of ground moraine and lacustrine sediments. In those areas where the relief amplitude varies from 30 to 50 m abundant outcrop occurs and the glacial debris consists of boulders, gravel, and sand deposits usually less than 1 m thick covering

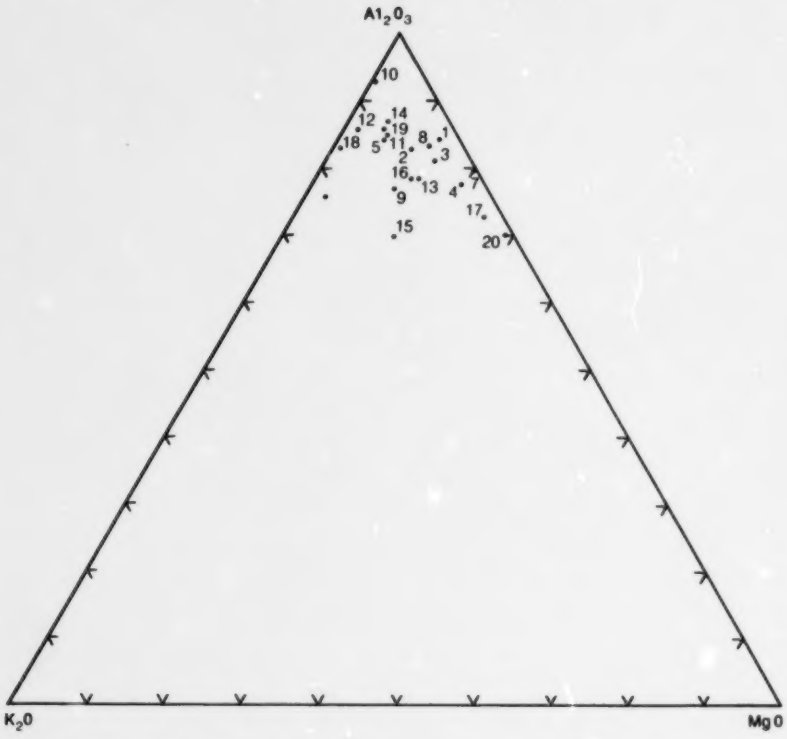


Figure 8. *Plot of 20 samples on AKM diagram.*

some 25 percent of the map area. Where relief varies between 10 and 30 m outcrop is more sporadically distributed and glacial debris consists of sandy and pebbly ground moraine with lacustrine clay filling low lying areas. Organic deposits of muskeg and bog fill the deeper depressions. In these areas glacial and organic deposits generally are less than 10 m thick and cover roughly 50 percent of the map area. Thicker zones, greater than 10 m but less than 30 m, of lacustrine clay and sandy till with little or no outcrop, cover 20 percent of the map area. Muskeg and bog deposits are most extensive over these areas.

Glacial plucking is common where joint patterns cut one another (Photo 13).

Covering about 5 percent of the map area are esker, esker-complex, kame, outwash delta (in large part lake modified but may include some reworked moraine), silt, sand, gravel, boulders, and several series of subparallel gently arcuate or sinuous transverse moraines 3 to 10 m high. These latter represent sublacustrine moraines formed during the retreat of the Wisconsinan ice cap (V.K. Prest, Consulting Geologist, Ottawa, personal communication, 1980). Glacial striae noted on outcrops in the map area trend generally in the direction of azimuth 230 degrees indicating ice movement from the northeast. However, in places two sets of striations were observed, the second being about azimuth 210 degrees. The lacustrine deposits were formed as bottom sediments of glacial Lake Agassiz. During the drainage phases of glacial Lake Agassiz the above mentioned transverse moraine ridges were formed. At least 25 stages of glacial ice retreat can be measured in the map area in that part just east of Maskooch Lake to the east boundary of the map area (V.K. Prest, Consulting Geologist, Ottawa, personal communication, 1980).

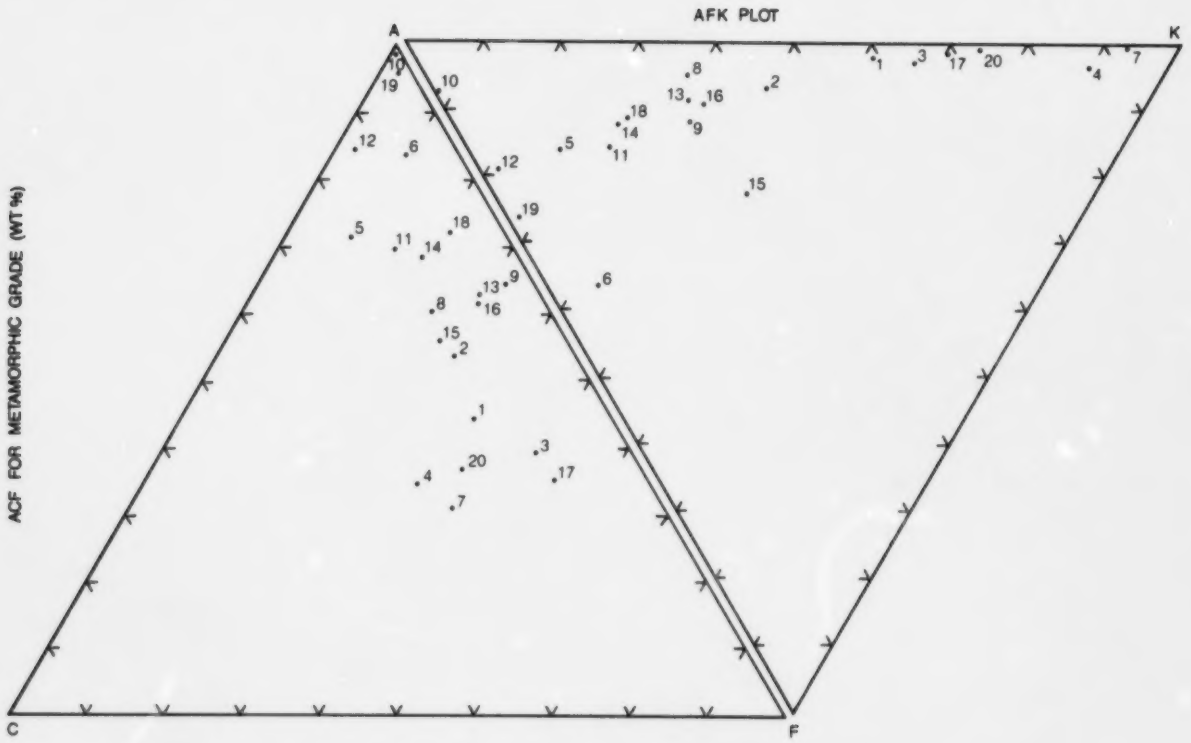


Figure 9. *Plot of 20 samples on ACF and AFK diagrams:*
A = $Al_2O_3 + Fe_2O_3 - (Na_2O + K_2O)$
C = $CaO - 3.3\ P_2O_5$
F = $FeO + MgO + MnO$
K = K_2O

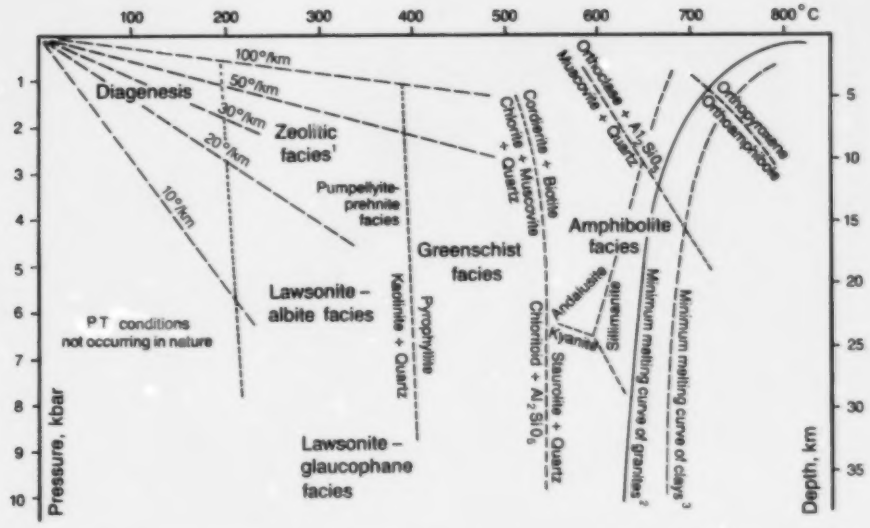


Figure 10. *Pressure and temperature conditions of metamorphism (after Winkler 1967, Figure 40, p.177).*

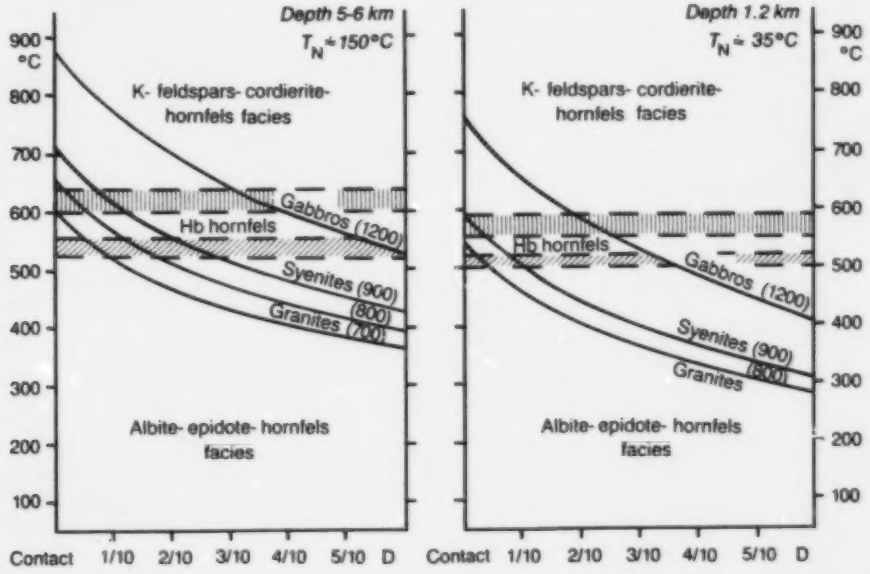


Figure 11. *"Heating of the country rock adjacent to various intrusions at a depth of 5-6 km and 1.2 km. Distance from the contact is given in fractions of D. D = thickness of the plate-like intrusion. Band marked by inclined ruling = beginning of the hornblende-hornfels facies. Band marked by vertical ruling = beginning of the K-feldspar-cordierite-hornfels facies". (Winkler 1967, Figure 19, p.83).*

Photo 13. *Glacial plucking where joint planes intersect in wacke on Avis Lake. Ice motion from left to right.*

Just northeast of Badrock Lake an esker outwash delta and esker are found. The esker-delta system is roughly 2500 m long in a westward direction and is composed of a rudely stratified accumulation of boulders, gravel, and sand.

Off the western end of Avis Lake a large end moraine and outwash delta exists. Two raised shorelines are noted from airphotos and the top of the moraine has been planed off. The bulk of the moraine is composed of rudely stratified boulder, gravel, and sand deposits.

Correlation of Geology With Geophysical Data

There are four aeromagnetic series map sheets for the area (Ontario Department of Mines–Geological Survey Canada 1960a, 1960b, 1960c, 1960d) as well as a gravity survey of a much larger area which was conducted by the Ontario Division of Mines (Barlow *et al.* 1976).

In general the total magnetic field intensity of mafic metavolcanic flows and their associated mafic intrusive sills and dikes, indicated on the aeromagnetic maps, exceeds 63 000 gammas. Felsic to intermediate metavolcanics and metasediments have total magnetic field intensity values generally on the order of 60 100 gammas and rarely less than 59 300 gammas. There is sufficient magnetic contrast to outline most of the mafic to intermediate metavolcanic units.

Felsic to intermediate intrusive rocks have magnetic values on the same order of magnitude as the felsic to intermediate metavolcanics with the exception of the Wassa Bay Pluton which exceeds 62 000 gammas. The western part of the Papaonga Lake Pluton shows values up to 61 400 gammas, however, the author believes this is caused by the strong influence of the ironstone deposit at Kesaka Lake to the north.

The magnetite ironstone exhibits magnetic intensity values of from 66 000 to over 80 000 gammas.

The smaller ironstone deposits near West Badrock and Badrock lakes range in total field intensity from 65 000 to 72 000 gammas. The large deposit at Kesaka Lake and its extension at Tepeka Lake range from 66 000 to over 80 000 gammas. From the author's examination of assessment data for ground magnetometer surveys over these deposits the magnetic contrast between the two deposits is not quite as pronounced, however, the Kesaka Lake deposit is considerably more extensive and it is buried whereas the deposits in the West Badrock Lake to Badrock Lake area are exposed, thus influencing the ground readings more than the airborne readings. The Jeanette Lake Batholith, northeast of the map area, is aeromagnetically rather flat.

Ground electromagnetic surveys were performed over several parts of the map area by private companies as part of exploration programs. Most conductors were small and could be attributed to conductive clay layers or water-filled faults or joints. The few larger conductors indicate sulphide zones which for the most part are associated with felsic to intermediate metavolcanic tuff to lapilli-tuff with some crystal tuff phases. Sulphide content ranges from 2 to 60 percent with an average of 5 to 15 percent. Most of the sulphide minerals are pyrite and some pyrrhotite with lesser amounts of chalcopyrite, sphalerite, and magnetite. Drilled conductors ranged in thickness from less than 1 to 8 m.

Structural Geology

BEDDING

Bedding was noted with reasonable confidence only in the metasediments, i.e. in shale, argillite, or mudstone and the chemical metasediments which are magnetitic chert or jasper interbedded with magnetitic ironstone. In some areas where good graded bedding is prominent in the wacke-mudstone units, bedding and top determinations could be made with a high degree of confidence. In the pyroclastic metavolcanic units grading is not prominent, and therefore, top determinations are not as reliable even where pillows are present.

FOLIATION, SCHISTOSITY, AND CLEAVAGE

Subparallel alignment of platy and acicular minerals such as biotite, muscovite, feldspar, and amphibole and the stretching of fragments as a result of deformation and metamorphism are evident throughout the map area, but are most prominent in the metavolcanic sequence and to a lesser degree in the metasediments. The intrusive rocks exhibit some mineral alignment, most prominently near contacts with metavolcanics and metasediments. The Uchi Lake metavolcanic sequence in the northwestern part of the map area trends N45E to N50E. The metavolcanics and metasediments of the rest of the Slate Lake area trend roughly N75E to N85E with local variations. The general foliation trend of the

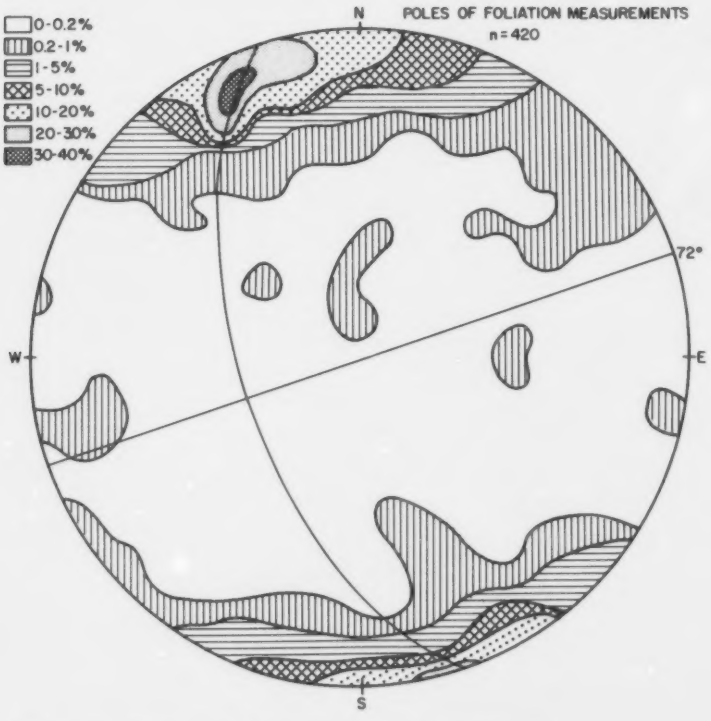


Figure 12. *Equal area plot of poles to planes of foliation.*

Photo 14. *Photomicrograph of carbonaceous mudstone showing graded bedding in sandy layers and well-developed slaty cleavage in the thin carbonaceous layers. Specimen from north shore of Slate Lake. 12x - X Polars.*

larger plutons and intrusive rocks tends to conform with that of the surrounding metavolcanics and metasediments. A high percentage of the foliation dips are steeply to the south (Figure 12). Discordance of bedding and foliation or schistosity was rarely observed, but does occur in some of the metasediments on Sawan Bay and on Badrock Lake.

Slaty cleavage was noted in some of the black shale or argillaceous rocks, especially where small sandy interbeds occur and tight folding or drag folding are exhibited. This is most notable along the north shore of Slate Lake and in or near the intrusive units. Photo 14 shows this feature on a microscale.

GNEISSOSITY

Gneissosity was noted only in the transition zone along the boundary between the Uchi Lake and English River subprovinces. Traversing south across this transition zone one passes from relatively low rank wacke and metavolcanics into metatex-

tites which are increasingly invaded by anatectic leucosome causing concentration of mafic minerals in linear bands alternating with the leucosome bands. Some gneissosity is developed along the contact of the Jeanette Lake Batholith and the metasedimentary sequence at Jubilee Lake.

LINEATION

Observed lineations are mainly parallel to foliation and include minor fold axes, crenulations or 'S' and 'Z' type microfolds or ptygmatic quartz veinlets, elongated mineral grains or mineral aggregates, slickensides, and elongated clastic and pyroclastic fragments. Figure 13 is a contoured equal area stereographic plot of 31 lineations taken over the map area. The general plunge of one set of lineations is 75 degrees at azimuth 253+. A secondary set of lineations plunges 80 degrees at azimuth 83 degrees.

JOINTS

Joint measurements were taken throughout the map area wherever they were prominent. About 50 were taken on either side of the point that projects into Avis Lake and divides it into two parts. The rock at that location is arkose to wacke in composition with pelitic tops. A total of 90 poles of joints are plotted on an equal area projection in Figure 14.

The most prominent set of joints has a strike trend of N32W and a dip of 80 degrees west. The second most prominent set of joints has a strike trend of N80E

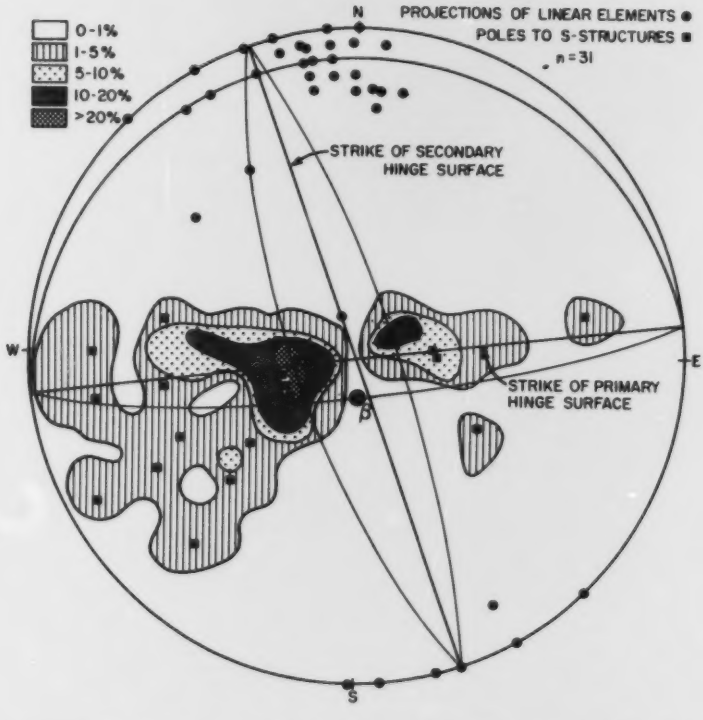


Figure 13. *Equal area plot of projections of linear elements and the poles to the S-structures on which the linear features were displayed.*

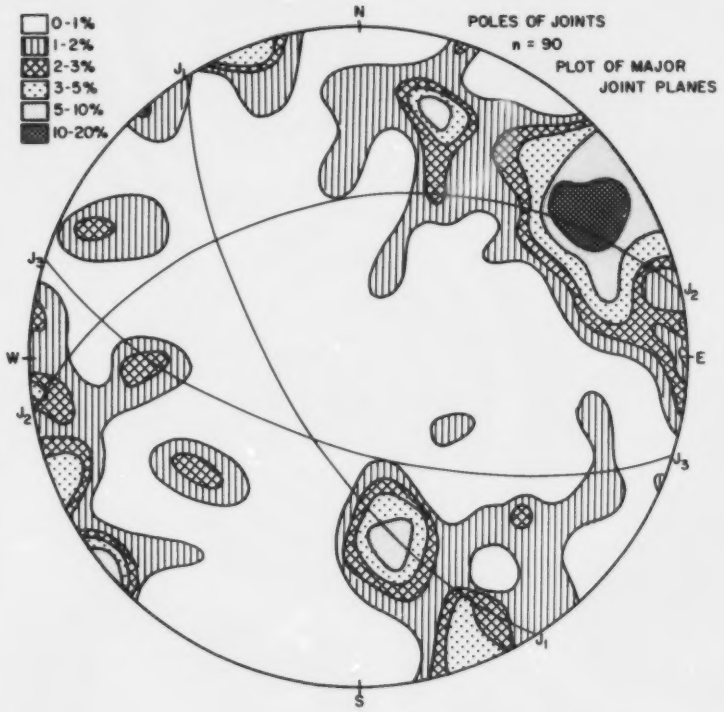


Figure 14. *Equal area plot of the poles to joints and planes of the three major joint systems.*

and a dip of 50 degrees north. There is a third significant joint set with a strike trend of N72W and a dip of 67 degrees southwest. Figures 15, 16, and 17 are equal angle stereographic projections of the several recognized joint systems in the map area.

FOLDS

In the northwestern part of the map area in the Uchi Lake metavolcanic sequence, there are a series of northeastward trending isoclinal folds. It is relatively easy to trace rock units and structures from Earngey Township to the north southward into the map area. Criteria used for establishing folds were facing directions mainly in mafic metavolcanics determined by pillow tops and flow top breccia, and in the metasediments and subareal tuffaceous metavolcanics by graded bedding. The most obvious fold axis supported by field evidence is the continued trend of the large regional anticlinorium which was delineated by Thurston (1978, p.112) in the adjacent area to the north. Mafic metavolcanic flows, which contain either coarse mafic flows or mafic sills, are folded isoclinally about this axis that trends southwestward into Bowerman Township approximately 4.75 km south of the northeast corner of Bowerman Township (*see* Figure 18).

Less well-defined synclinal axes parallel this anticlinal axis to the west and east and can also reasonably be extended into Bowerman Township. Evidence for the eastern synclinal axis trending through the south arm of Leg Lake and southwest through to Bowerman Township boundary is supported by the coarse-grained mafic rocks with interbedded intermediate metavolcanic units that wrap

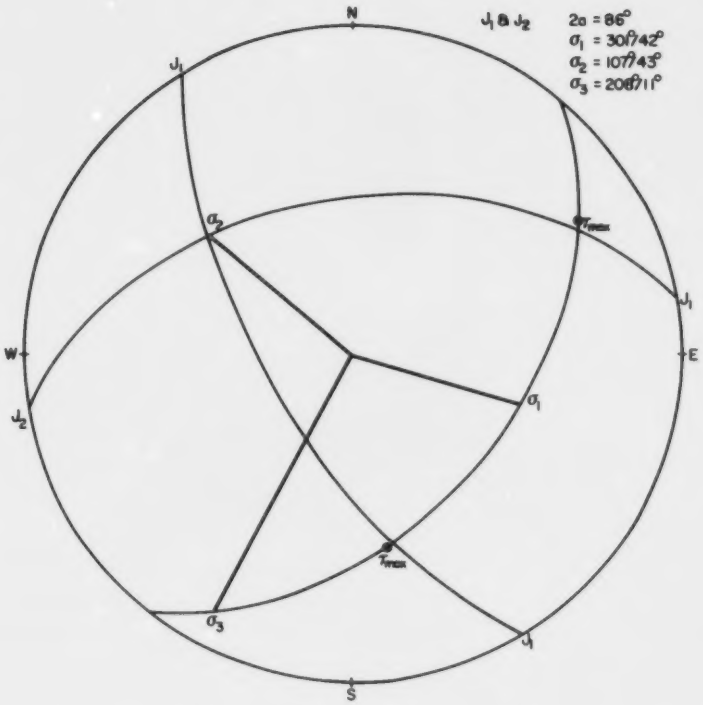


Figure 15. *Stereogram showing the resolution of the greatest, intermediate, and least forces from joint systems J_1 and J_2.*

around the arm and repeat on the other side. At Neepawa Bay of Uchi Lake a syncline to the west and an anticline to the east of the Uchi Lake Fault is suggested by opposing top determinations in the metasediments and pillow tops in the mafic metavolcanics. The metavolcanic sequence becomes narrower as it extends southwestward. Lineations plunging 75 to 85 degrees southwest suggest that the fold axes plunge in that direction. Whether the form of the metavolcanic sequence is due to folding and plunge cannot be accurately determined. Folds with less field evidence are shown on the diagram in Figure 19. In addition, changes in the normal southward top direction and repeated units suggest isoclinal folding. The thinning of the units both eastward and westward suggest plunging in those directions and imply secondary or superimposed folding.

A number of felsic to mafic plutons intrude the metavolcanic and metasedimentary rocks commonly parallel to the trend of foliation in the surrounding rocks. Figures 19 and 20 demonstrate the effects of the forces exerted by upwelling felsic magma on the mafic metavolcanics and metasediments.

With an increase in distance south from the Uchi Lake metavolcanic sequence the trend of foliation and the postulated fold axes take on a more eastward trend. This separation seems to have been caused by the intrusion of a series of felsic batholiths northeast and southwest of the map area.

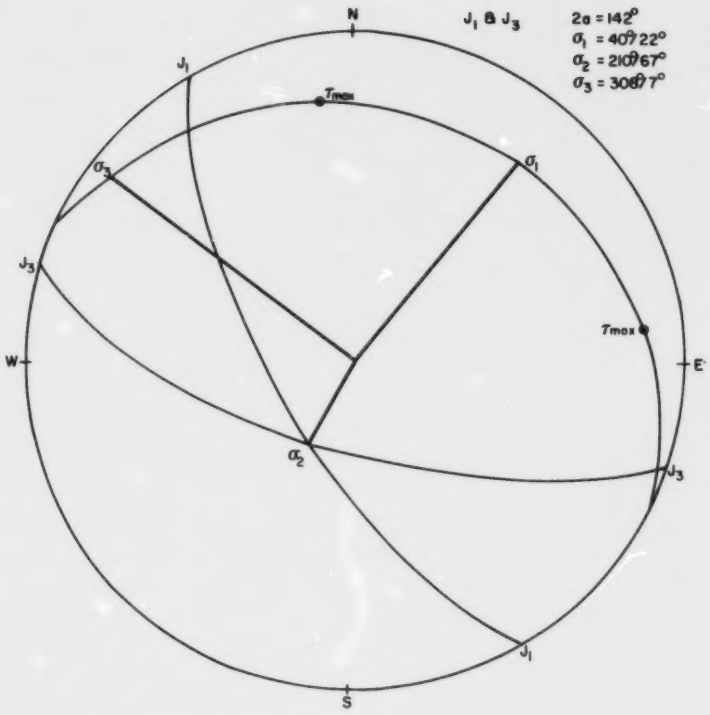


Figure 16. *Stereogram showing the resolution of the greatest, intermediate, and least forces from joint systems J_1 and J_3.*

FAULTS

Offsets in stratigraphy, aeromagnetic and gravity data, zones of shearing, and topographic features as determined from air photographs were all used to identify faulting.

Topographic lows prevent direct observation of faults and significant offset of stratigraphy was not noted, except in the extreme northwestern part of the map area. The Uchi Lake Fault passes through the northwest corner and shows little stratigraphic offset on formations, but brecciation, silicification, carbonatization, and schistosity are present. Observations of brecciation, schistosity, silicification, and carbonatization along both shores of Slate Lake coupled with the linear shape of the lake suggest a fault or shear zone. Displacement is unknown, however, lineations and slickensides indicate some movement along planes of foliation with the downdropped side to the north. Aeromagnetic lows (Ontario Department of Mines–Geological Survey of Canada 1960d) exist along the traces of the Uchi Lake Fault, Slate Lake, and the Papaonga River System, the latter being somewhat masked by ironstone concentrations and may be indicative of faulting. However, synclinal axes are commonly characterized by magnetic lows as well. Offsets in the aeromagnetic data in the northwestern part of the map area correlate well with fault offsets. In the northwest corner, northeastward trending strike-slip faults are cut and in places offset by northwestward trending shorter faults.

Topographic lineaments and aeromagnetic trend dislocations are for the most part absent in the rest of the map area. The Papaonga Lake Pluton and the

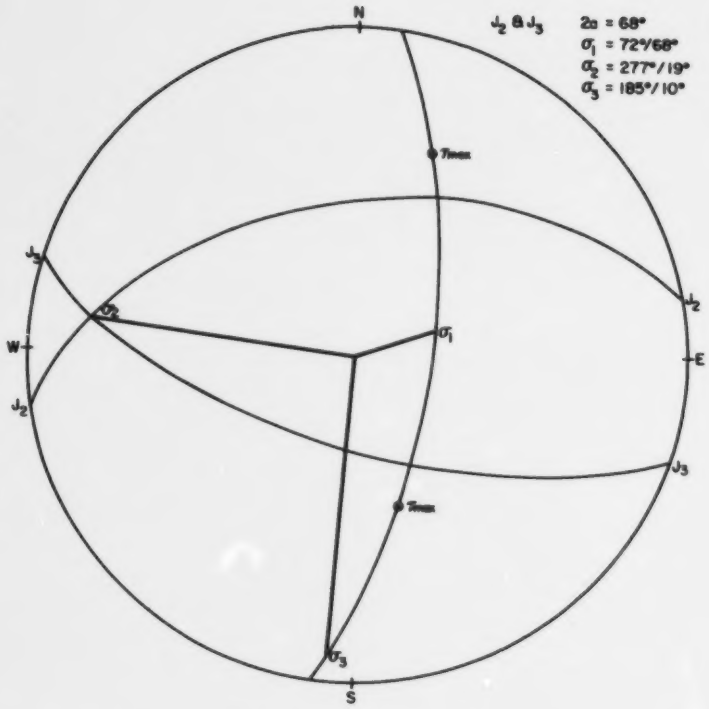


Figure 17. *Stereogram showing the resolution of the greatest, intermediate, and least forces from joint systems J_2 and J_3.*

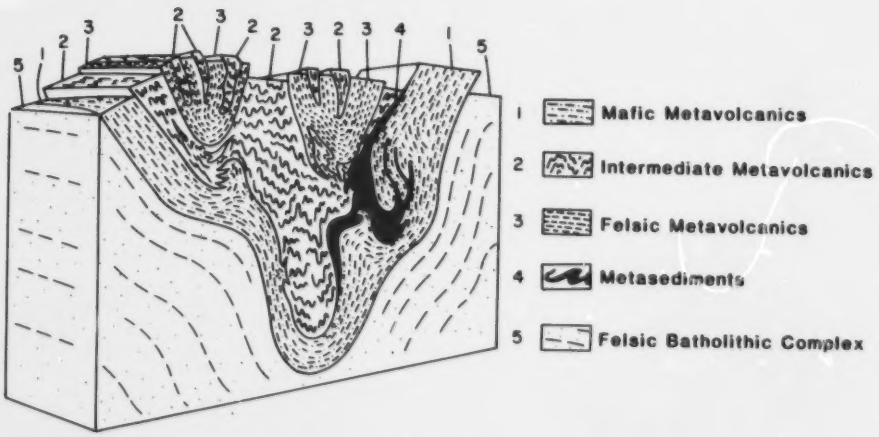


Figure 18. *Diagram showing the initial stages of isoclinal folding caused by a rising body of granitic magma which lends itself to being the intermediate stress or confining pressure with gravity being the primary stress. The least stress would be directed parallel to the axis of the fold (after Metzger 1947, Figure 1).*

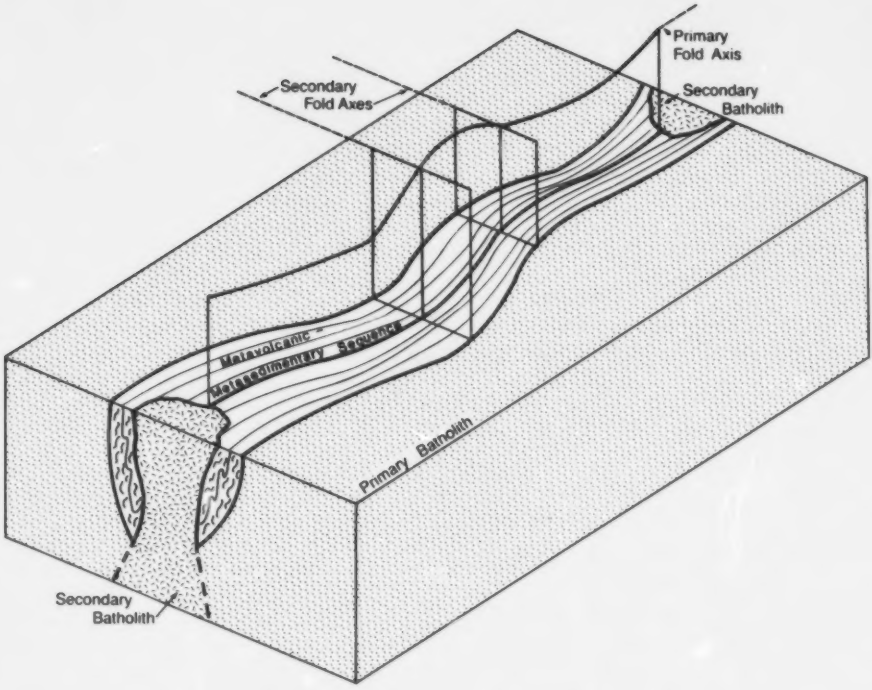


Figure 19. *Diagram showing the effect of the intrusion of a second series of batholiths along the axis of synclines causing flexures and secondary folding perpendicular to the initial fold axis.*

Tepeka Lake Stock exhibit a series of cross fractures highly visible on air photographs and easily noted on the ground. These may reasonably be attributed to cooling. No movement along them is evident.

To the west of the map area the Sydney Lake Fault marks the boundary between the Uchi Lake Subprovince and the Northern Supracrustal Domain of the English River Subprovince (Breaks *et al.* 1978). The fault is characterized by a 1 to 2 km wide zone containing protomylonitic and mylonitic equivalents of migmatized metasedimentary, felsic plutonic, and metavolcanic lithologies (Breaks *et al.* 1978). The mylonite zone is most severe along the contact between the English River Subprovince migmatized metasediments and metavolcanics or granitoids of the Uchi Subprovince (Breaks *et al.* 1978).

No mylonite zone was encountered in the map area, however, outcrop in the area is limited and a series of eastward trending streams and sharp topographic lineaments observable on air photographs in the author's opinion still leave the possibility that the Sydney Lake Fault passes through the map area and joins with the Lake St. Joseph Fault zone to the east (*see* Figure 21).

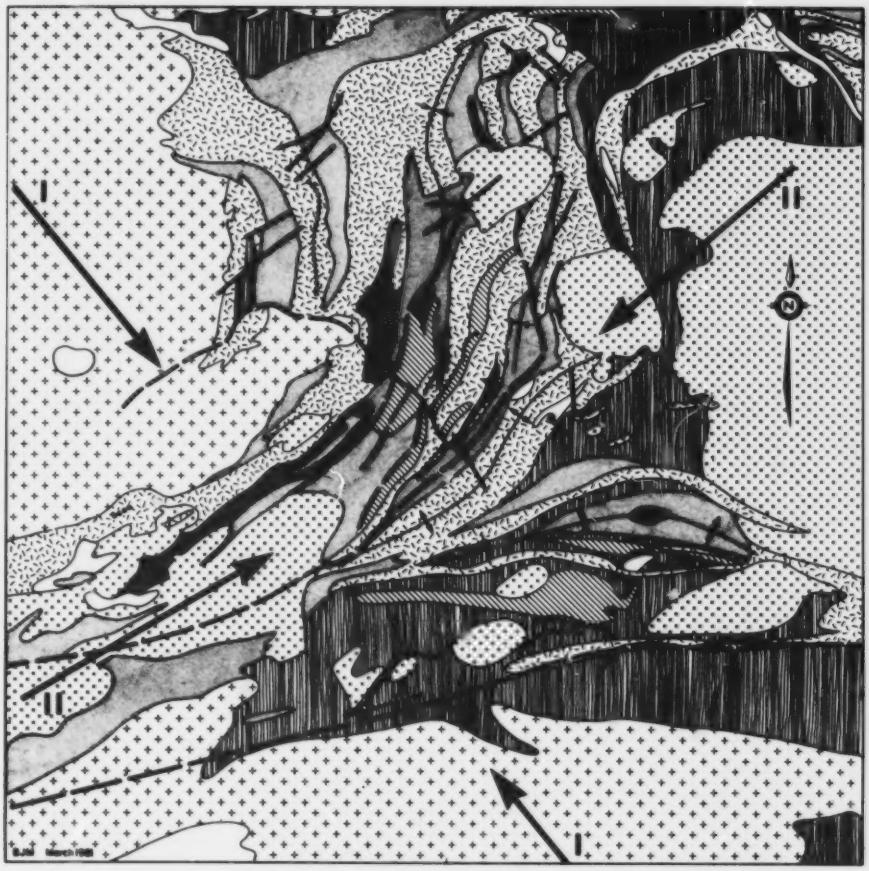


Figure 20. *Diagram showing directions of force exerted by batholiths.*
I - First stage of intrusive activity
II - Second stage of intrusive activity

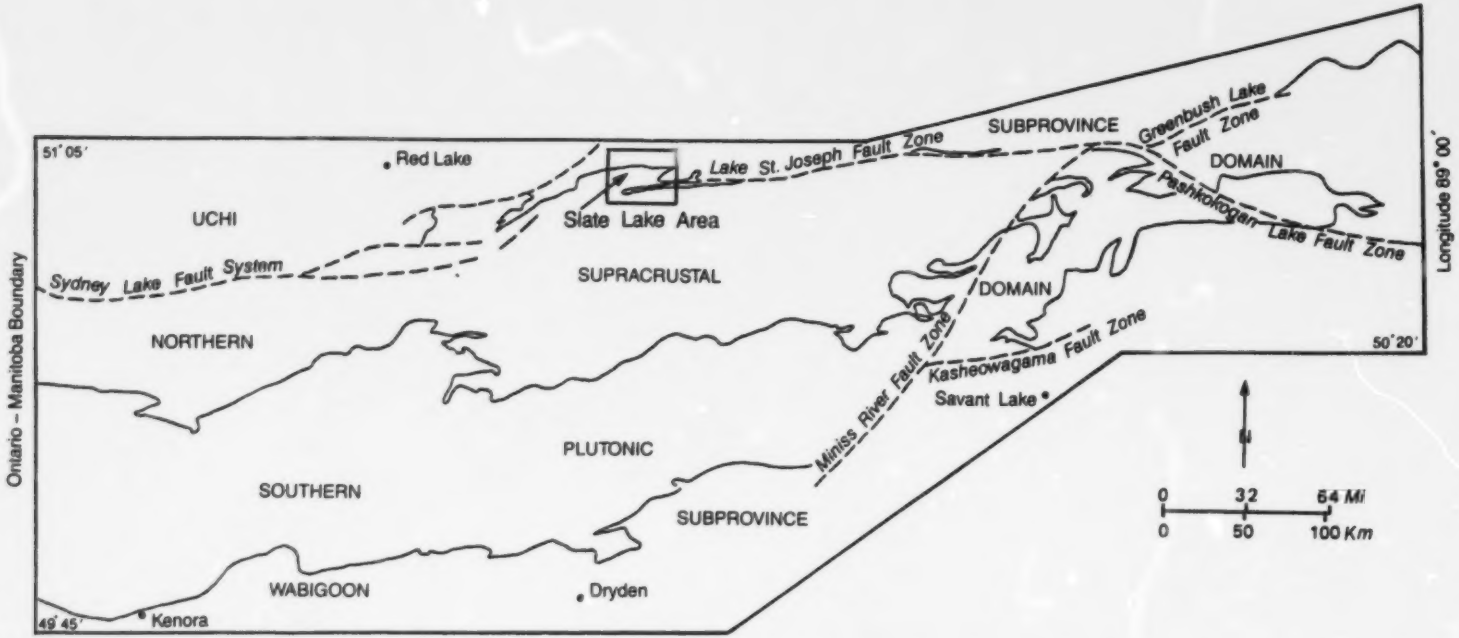


Figure 21. *Distributions of major fault systems in the English River Subprovince and adjoining segments of Uchi and Wabigoon subprovinces (Breaks et al. 1978, Figure 13, p.34).*

Economic Geology

The map area and adjacent areas to the north within the Uchi metavolcanic belt were extensively prospected between 1925 and 1930 for gold, but with little success in the map area. Activity tapered off due to the success of mining activity in the Red Lake camp to the west. Renewed interest in the area occurred in 1937 to 1939 with the discovery on the Uchi Lake Gold Mines Limited property which had a productive life from 1938 to 1945.

Prospecting activity for gold was renewed about 1945 on the property of the Panama Lake Occurrence (7) first by J. Pemmican and J. Hagar followed in succession by C.A. Campbell in 1951, J. Kolak and K. Koezur in 1958, and in 1960 with additional work by H. Pokolm.

In 1956 to 1957 prospecting activity for base metals, notably iron ore, began as a result of an airborne magnetic survey across the southern part of the map area which delineated several high magnetic anomalies. Quebec Labrador Development Company (9) and El-Sol Gold Mines Limited (3) (later Tex-Sol Explorations Limited) staked several of the anomalous areas and conducted ground magnetometer and some ground electromagnetic work followed up by diamond drilling. The El-Sol property around Kesaka Lake was taken to lease and is held at present by Tex-Sol Explorations Limited (11). Aumaque Gold Mines Limited (1) conducted a ground magnetic and a resistivity survey within the Papaonga Lake Pluton and followed up with some diamond drilling. Results of all work undertaken during this period except for the Kesaka Lake deposit were disappointing.

Another surge of exploration activity for base metals occurred during 1969 to 1970. Dome Exploration (Canada) Limited (2) conducted an airborne electromagnetic survey in the northwestern part of the area followed up by ground magnetic and electromagnetic surveys and diamond drilling. Halren Mines Limited (4) and the Keevil Mining Group Limited (5) staked extensive ground around Anape Lake, Lower Slate Lake, and the southwestern end of Slate Lake and conducted ground magnetic and electromagnetic surveys over these properties. Noranda Exploration Company (6) carried out a considerable ground geophysical program east of Maskooch Lake about that same time. Ernest Prieston (8) did some x-ray drilling and trenching in 1971 on some of the ground previously held by Quebec Labrador Development Company Limited west of West Badrock Lake. All this exploration activity bore no economic results.

Prospecting activity remained dormant until St. Joseph Explorations Limited (10) conducted a large-scale airborne magnetic survey over much of the surrounding area. As a result a number of claim groups were staked within the map area. Ground magnetometer and ground electrometer surveys coupled with geological mapping were conducted with follow-up diamond drilling of some selected targets. To date diamond drilling has not revealed significant mineralization, however, several targets remain and drilling is continuing.

GOLD

Inasmuch as most of the gold exploration had been done over 30 years ago, pits, drill sites, and core are in poor condition. Thomson (1939) and Bateman (1940) provide the best early descriptions of the Uchi Lake deposits. More recent information is provided by Thurston (1978).

VOLCANOGENIC Cu-Pb-Zn-Ag MASSIVE SULPHIDE DEPOSITS

The first attempt at base metal exploration, besides iron, took place during the period 1969 to 1971.

Aumaque Gold Mines Limited began a search along a geophysically inferred contact between metavolcanics and the Papaonga Lake Pluton. However, the diamond drilling program proved the mafic metavolcanics to be in fact wacke. Some pyrite with stringers of quartz was reported, but no assay reports are available.

Halren Mines Limited and the Keevil Mining Group Limited based their exploration programs on finding a similar geological environment to Selco Mining Corporation Limited's South Bay Mine in Mitchell Township (northwest of the map area). Selco's deposit is toward the top of Thurston's (1978) Cycle III metavolcanics which are essentially interbedded with rhyolitic flows and pyroclastic rocks intruded by quartz-feldspar porphyry. Only Cycle I metavolcanics and the lowermost part of Cycle II metavolcanics occur within the map area. The rhyolite associated with the volcanism is mostly of tuffaceous to lapilli-tuff character and associated massive sulphide mineralization has not been detected. A good felsic pyroclastic breccia does occur on the north shore of Lower Slate Lake, however, the extent of this unit is thought to be very limited.

Noranda Exploration Company carried out an exploration program for massive sulphide mineralization east of Maskooch Lake. Most of their work was in felsic to intermediate metavolcanics which most likely have some associated sulphide mineralization, but pyroclastic rocks associated with ultramafic to mafic metavolcanics do not occur in that area. No follow-up drilling was done on any of their magnetic and electromagnetic targets.

IRON

Ironstone deposits were first noted in the earliest geological surveys but were not extensively prospected until the late 1950s when airborne magnetic anomalies were staked and follow-up ground geophysical work was done. Where drilling was done only the Kesaka Lake deposit recorded overall grade in excess of 30 percent Fe. The ironstones are magnetitic chert or jasper interbedded with magnetite ironstone. Some specular hematite was noted with some of the jaspilitic ironstone. Most of these ironstones occur along the interface between wacke metasediments and felsic metavolcanics, usually of a tuffaceous nature. Feldspar and quartz-feldspar porphyries commonly intrude along this interface or nearby and in some cases plutons or stocks intrude these same rock units within a short distance of the ironstone occurrence.

DESCRIPTION OF PROPERTIES

The following are descriptions of all former and existing properties up to January 1981, for which assessment work was recorded with the Ministry of Natural Resources. Leased claims and former properties which have been restaked are discussed under the name of the current recorded holder. Former properties which are currently open to staking are discussed under the name of the last holder to file assessment work, and the date of that work is given in square brackets.

To assist the reader a sketch map (Figure 22) outlines the claim groups for which assessment work has been filed.

Table 5 lists all claims staked for which assessment work has been filed as of January 1981 and the type of work and date such work was done.

AUMAQUE GOLD MINES LIMITED [1957] (1)

Aumaque Gold Mines Limited staked 24 claims in the map area numbered KRL 39623 to 39646 inclusive in 1956.

That year the company contracted Geo-Technical Development Company Limited to carry out ground magnetometer and resistivity surveys on the prop-

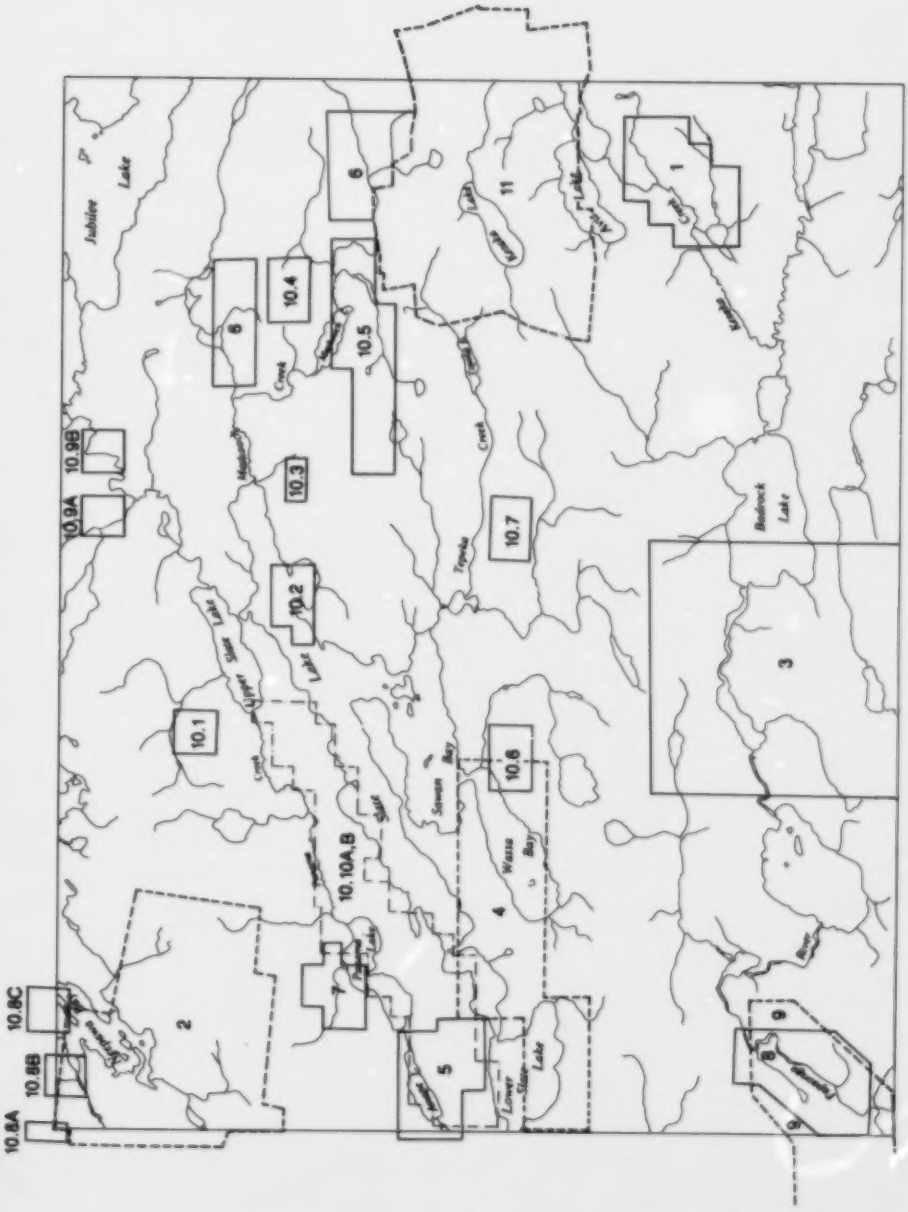


Figure 22. *Property location map for the Slate Lake Area.*

TABLE 5. PAST AND PRESENT OWNERS OF CLAIM GROUPS AND TYPE OF WORK PERFORMED TO JANUARY 31, 1981. (Data from Resident Geologist's Files, Ministry of Northern Development and Mines, Red Lake, Ontario.)

	TYPE OF WORK															
	Geo-logical	Dia-mond Drill-ing	Core Samples	Air-borne Magnet-ometer	Air-borne Electro-magnet-ometer	Air-borne Radio-metric	Ground Magnet-ometer	Ground Electro-magnet-ometer	Ground Radio-metric	Induced Polar-ization	Self Poten-tial	Resist-ivity	Grav-ity	Geochem-ical	Trench-ing	Assay Results
1. Aumaque Gold Mines Ltd.	57	57					56					56				
2. Dome Exploration (Canada) Ltd.		70			69		70	70								70
3. El-Sol Gold Mines Ltd.							57									
4. Halren Mines Ltd.							69	69								
5. Keevil Mining Group Ltd.							69									
6. Noranda Exploration Co.							69	69								
7. Panama Lake Occurrence		46														74
8. Prieston Occurrence		71														
9. Quebec Labrador Dev. Co. Ltd.		57	57	57	57		57									57
10. St. Joseph Explorations Ltd.	78	79					78,80	78,80								
11. Tex-Sol Explorations Ltd.	57	57					56									57

Note: Numbers in table are year work done, i.e. 57 for 1957.

erty. A Wolson type magnetometer and a resistivity unit were used. The claims lie wholly within the Papaonga Lake Pluton which is dioritic in composition. Very few outcrops occur in this area so geophysical interpretation was difficult. A magnetic anomaly detected along Kesaka Creek is probably associated with the contact between the Papaonga Lake Pluton and the metasediments to the northwest. Several small resistivity anomalies were delineated and diamond drilled.

In 1957, Continental Diamond Drilling Company Limited drilled seven holes for Aumaque for an aggregate footage of 3669 feet. Although the drill logs note greywacke and amphibolite the author believes the rock to be dioritic. Some quartz stringers and pyrite are also reported in the logs. Apparently drill results were not encouraging since no assay data are included with the drill logs and cross sections. The claims were in good standing for several years, however, no mention of them in company publicity appears after 1960 and the claims have reverted to the Crown.

DOME EXPLORATION (CANADA) LIMITED [1970] (2)

Dome staked 94 claims in the northwestern part of the map area in 1969. These were claim numbers KRL 66489 to 66524 inclusive, 66531 to 66558 inclusive, 64421 to 66438 inclusive, 64458, 61739, and 61760 to 61769 inclusive. Dome Exploration (Canada) Limited is a wholly owned subsidiary of Dome Mines Limited. That year Canadian Aero Surveys Limited flew an airborne electromagnetic, magnetic, and gamma ray spectrometer survey over the area. Flight lines were spaced at 0.125 mile intervals and mean terrain clearances were 150 feet. The flight lines were oriented at azimuth 315 degrees, roughly perpendicular to the trend of the Uchi Lake metavolcanic sequence that passes through the claim group. Several strong to moderate E.M. conductors coinciding with magnetic highs were delineated.

In 1970, ground magnetic and electromagnetic surveys were conducted over 66 of the 94 claims, KRL 66489 to 66524 inclusive, 66531 to 66558 inclusive, 64421 to 64437 inclusive, 664458, 61739 and 61760 to 61769 inclusive by Prospecting Geophysics Limited. The grid was cut at the same azimuth as the flight lines. Two major magnetic anomalies were delineated. The author found that the anomaly in the southeastern part of the claim group was caused by magnetitic ironstone and was also close to a mafic intrusion whereas the anomaly in the northwestern corner was caused by magnetitic ironstone and a mafic dike. This was the interpretation made by Prospecting Geophysics Limited. Electromagnetic conductors of the highest intensity and magnetic anomalies of the highest intenstiy did not necessarily coincide. Sulphide minerals, some magnetite, and possibly some graphite were suspected as the cause of the geophysical anomalies. A Sharp MF-1 fluxgate magnetometer and a Ronka Mark IV horizontal loop were used to conduct the ground geophysical survey. Dome contracted Fathom Diamond Drilling to drill two holes on claim KRL 66536 and one hole on each of claims KRL 66537, 66545, 61759, and 61761 totalling 1853 feet to test the E.M. anomalies.

Most of the rock encountered in drilling was felsic to intermediate tuff to tuff-breccia interbedded with some wacke and cut by a mafic dike 5 to 10 feet wide. Sulphide mineralization and some magnetite ironstone were intersected, but assay values were nil to trace for gold, nil to trace for silver, and nil to 0.13 percent for copper, and nil to 0.5 percent for zinc.

Intersections were generally 2 to 15 feet, however, one hole had two sulphide mineralization intersections of 50 and 55 feet each, but values were poor. Dome let these claims revert to the Crown.

EL-SOL GOLD MINES LIMITED [1957] (3)

In 1956 El-Sol Gold Mines Limited staked 156 contiguous claims along the Papaonga River just west of Badrock Lake numbering KRL 40988 to 41135 inclusive and 41180 to 41187 inclusive. The staking was done over the anomalies delineated by an airborne magnetic survey flown for Newkirk Mining Corporation Limited in 1956 by Aeromagnetic Surveys Limited.

In 1957 Geo-Technical Development Company Limited conducted a ground magnetometer survey over two blocks of the claim group. The north block consisted of 35 contiguous claims, and the south block consisted of 37 contiguous claims. A total of 49.3 line miles were surveyed. The airborne anomalies were further delineated by the ground survey and proved to be several thin, roughly parallel anomalies.

Outcrop is scarce in the southern part of the area, however, metasediments in the form of wacke and magnetitic chert interlayered with magnetitic ironstone were found and reasonably explains the magnetic anomalies. The compass is severely affected over much of the area indicating ironstone not far below the drift cover.

The northern block has considerably more outcrop. Eastward trending magnetitic chert interlayered with magnetitic ironstone occurs along the contact between felsic metavolcanic tuff to lapilli-tuff to the north and wacke to the south. A feldspar porphyry intrusion, possibly related to the West Badrock Lake Pluton cuts the wacke unit and the ironstone, however, it was not found to intrude the felsic metavolcanics. The ironstone is offset in two places from 30 to 100 m by northward trending right separation faults. In places the ironstone-chert-wacke sequence is highly contorted and folded apparently caused by loading prior to lithification. Larger scale faults may be present causing the ironstone units to be repeated, however, outcrop exposure is insufficient to verify this theory. Diamond drilling was recommended by Geo-Technical Development Company Limited to El-Sol Gold Mines Limited, however, it was never done and the claims reverted to the Crown.

HALREN MINES LIMITED [1969] (4)

Halren Mines Limited staked 97 claims in the map area in 1968. (KRL 68164 to 68228 inclusive; 68239 to 68243 inclusive; 717676 to 717750 inclusive; 200246 to 200262 inclusive). In 1969 magnetic and electromagnetic surveys were conducted by Shuto Explorations Limited over 65 of these claims.

A magnetic anomaly coincides with a mafic metavolcanic flow and pillow lava sequence that trends eastward across the claim group from Lower Slate Lake in the west along the north shore of Wassa Bay of Slate Lake in the east. Electromagnetic anomalies were rather randomly oriented over the property, the strongest coincided with the mafic metavolcanic unit mentioned above. The author believes the conductors were sulphide minerals in the mafic metavolcanic unit. The anomalies were not drilled. Halren Mines Limited became inactive in 1975 and their charter was cancelled in 1976. The claims have reverted to the Crown.

KEEVIL MINING GROUP LIMITED [1969] (5)

In 1968, Keevil Mining Group Limited part of Teck Corporation Limited staked 20 contiguous claims centred around Anape Lake and numbered KRL 67606 to 67620 inclusive, and 224403 to 224407 inclusive.

A ground magnetic and electromagnetic survey was performed by Geophysical Engineering & Surveys Limited in 1969 over 15 of these claims.

The magnetic anomaly north of Anape Lake is most likely caused by the mafic intrusion which trends northeastward. The magnetic anomaly south of Anape Lake is caused by the eastward trending mafic metavolcanic sequence.

Electromagnetic conductors appear to follow contacts between the mafic intrusions and intermediate to mafic metavolcanics in the north and the contact between felsic and intermediate metavolcanics just north of Anape Lake. Conductors south of the lake appear to follow the contact between intermediate and mafic metavolcanics and between various mafic metavolcanic flows. Concentrations of pyrite and possibly graphite are the probable cause of these anomalies. No drilling was done and the claims have since reverted to the Crown.

NORANDA EXPLORATION COMPANY [1969] (6)

Noranda Exploration Company staked two groups of claims in 1969, one north of Maskooch Lake, the other south of Maskooch Lake.

The northern claim group consists of 12 contiguous claims numbered KRL 66126 to 66137 inclusive. An east-west base line with cross lines 400 feet apart was cut. The geophysical survey was run on these lines and consisted of a magnetometer survey and an electromagnetic survey.

The rock underlying the claim group is nearly all eastward trending felsic metavolcanics, tuff, and lapilli-tuff with some volcanically derived wacke in the northernmost limits of the group.

The best correlation between the magnetic and electromagnetic data is across claims KRL 66135 to 66137 inclusive and is probably caused by pyrite concentration along the contact between two felsic metavolcanic units. No drilling was done and the claims have since reverted to the Crown.

The southern group consisted of 27 claims numbered KRL 201969 to 201978 inclusive and 66081 to 66097 inclusive east of Maskooch Lake and north of Kesaka Lake. In 1969, a geophysical survey including a ground magnetometer and a ground electromagnetometer survey were run. Two base lines at azimuth 315 degrees with perpendicular cross lines at 400 feet intervals formed the grid. With the exception of the southernmost four claims, which are underlain by volcanically derived arkosic wacke, the whole area is underlain by felsic metavolcanic tuff and lapilli-tuff.

Magnetic highs were random and isolated without any perceptible trend.

Electromagnetic conductors were mostly weak and did not correlate with magnetic anomalies except at the claim boundary between KRL 201969 and 66081 on the south and KRL 66086 and 66087 to the north which is roughly where the felsic metavolcanic-metasedimentary contact is postulated to occur.

No further work was done and these claims have reverted to the Crown.

PANAMA LAKE OCCURRENCE [1974] (7)

In 1945, J. Pemmican and J. Hager staked eight claims, KRL 23173 to 23180 inclusive, on the north shore of Panama Lake. The claims were transferred to Pemmican Mines Limited under whose ownership surface work and diamond drilling were performed in 1946 (Northern Miner Press 1946, p.240). In 1951, the claims were transferred to Colin A. Campbell. No work was reported and the claims were cancelled.

In 1958, J. Kolak and K. Koezur staked 12 claims in the area, however, no work was reported and the claims lapsed only to be restaked by Kolak in 1960 and allowed to lapse again.

H. Pokolm worked the property in the 1940s. The exact location of the showing cannot be ascertained from assessment files in the Resident Geologist's Office, Ministry of Natural Resources, Red Lake, Ontario, or reports in the Mining Recorder's Office in Red Lake. A brief note by former Resident Geologist, R. Thompson, dated 17 August, 1975, is all that can be found. Thompson reported

assay values of the Campbell showing made by H. Buckles as 0.01, 0.16, 0.06, 0.04, 0.26, 0.01, 0.04, Tr and Tr, ounces per ton gold.

Remains of a camp and some core can be found on the north shore of Panama Lake. Samples of the core sent to the Geoscience Laboratories, Ontario Geological Survey, Toronto, by W.W. Valiant of the Resident Geologist's Office, Ministry of Natural Resources in Red Lake assayed Tr Au and Tr Ag and Nil Au and Nil Ag. Core samples were felsic tuff to lapilli-tuff with some quartz veins.

The property is underlain by a series of felsic to intermediate tuffaceous metavolcanic units with lesser mafic metavolcanic and metasedimentary units. Siltstone and wacke, most likely volcanically derived, are interbedded with the tuffaceous units. Quartz veining is not prominent in the area. Foliation defined by alignment of mafic minerals, crushed pumice fragments, and mineral crystals runs roughly at azimuth 70 degrees and dips vertical to 80 degrees south.

All these claims have reverted to the Crown.

PRIESTON OCCURRENCE [1971] (8)

Seventeen claims KRL 281201 to 281218 inclusive were staked in 1971 by Ernest Prieston. An airborne magnetic anomaly delineated on Aeromagnetic Map 871g (Ontario Department of Mines–Geological Survey of Canada 1960a) is on two of these claims KRL 281209 and 281211.

During 1971, 284 feet of trenching and 608 feet of x-ray diamond drilling in five holes on claims KRL 281205, 281210, 281213, and 281214 were done.

No results were filed for assessment. A plot of the holes on the author's geology map indicates they were drilled too far from either side of the anomaly to strike the target which appears to have been the magnetitic ironstone drilled by Quebec Labrador Development Company in 1957.

It appears that all the diamond drilling was done in wacke of the metasedimentary sequence.

QUEBEC LABRADOR DEVELOPMENT COMPANY LIMITED [1957] (9)

In 1956 and 1957 Quebec Labrador Development Company Limited staked 64 claims, 31 of which were inside the southwestern part of the map area. The claims were staked along the airborne magnetic anomaly delineated by the airborne survey flown by Aeromagnetic Surveys Limited for Newkirk Mining Corporation Limited in 1956. A total of 64 claims were staked KRL 39693 to 39756 inclusive of which 31 (KRL 39726 to 39756 inclusive) were inside the map area.

A ground magnetometer survey was conducted on the property in 1957. A base line and tie lines were oriented at azimuth 45 degrees with survey lines oriented perpendicular to them or at azimuth 315 degrees. A strong magnetic anomaly was delineated.

The area is underlain by volcanically derived wacke and arkose trending northeastward and a felsic to intermediate pluton (West Badrock Lake Pluton) in the eastern part of the claim group. The magnetic anomaly is caused by a magnetitic chert interbedded with magnetite ironstone which parallels the trend of the enclosing rocks.

Continental Diamond Drilling Company drilled 13 holes totalling 6795 feet, 11 in the map area, totalling 5398 feet. Of these, eight intersected the ironstone. The author used the assay results and drill intersections of the thickest units that interconnect between drillholes to calculate an average true thickness of 161 feet with an average grade of 20.12 percent Fe over a strike-length of 11,000 feet.

Average magnetite content is 35 to 40 percent. The last report concerning these claims and Quebec Labrador Development Company Limited was in the

1961 issue of the Canadian Mines Handbook issued by the Northern Miner Press (1961, p.201). In April 1963, Quebec Labrador Development Company Limited merged with Salem Exploration Limited. These mining properties have since reverted to the Crown.

ST. JOSEPH EXPLORATIONS LIMITED (10)

Between 1977 and 1980, St. Joseph Explorations Limited held nine groups of claims in the map area. These are described separately in the following section.

Upper Slate Lake Grid 5 (10-1)

Grid 5 consists of four contiguous claims KRL 463851 to 483654 inclusive and were staked in 1977 and are located about 500 m north of the western end of Upper Slate Lake.

A base line running at azimuth 55 degrees through the point where the four claims join together with survey lines perpendicular to it at an azimuth of 325 degrees and 100 m separation and survey stations at 30 m intervals form the survey grid used for a ground magnetometer and horizontal loop electromagnetic survey which totalled 6.1 line kilometres.

A 100 m line spacing and a 25 m station interval was used in grids 6, 7, 15, 16, 35, 36 Wassa Bay and Tepeka Creek grids. The geophysical survey was run in 1978.

The geology underlying the claim group consists of eastward to northward trending intermediate and felsic metavolcanics with some volcanically derived wacke underlying the northwestern part of the claim group. A magnetic anomaly roughly coinciding with an electromagnetic conductor, both trending in a northward direction, appear to the author to be caused by a contact between felsic metavolcanics to the north and intermediate metavolcanics to the south.

Detailed mapping, soil sampling, and rock geochemistry were recommended by the company to attempt to better explain the magnetic and electromagnetic anomalies.

Slate Lake Grid 16 (10-2)

Grid 16 consists of nine contiguous claims KRL 504041 to 504049 inclusive, was staked in 1977, and is located on the south shore of Slate Lake 1.2 km due south of the rapids connecting Upper Slate Lake with Slate Lake.

A grid was laid out at azimuth 64 degrees. A ground magnetometer and a ground electromagnetic survey was conducted over the grid in 1978.

The claim group is underlain by intermediate and mafic metavolcanics interbedded with cherty sulphide and oxide ironstone trending generally northeastward and dipping sharply to the south. It is this latter unit that is expressed by a strong electromagnetic conductor which extends some 130 m in length across the claim group and coincides quite well with a magnetic high.

Samples taken by the author's field crew from surface showings of sulphide mineralization along the strike of this unit did not carry significant values of gold and silver (Geoscience Laboratories, Ontario Geological Survey, Toronto). Sample locations and values are tabulated in Table 6.

This area was drilled in 1977 by St. Lambert Drilling for St. Joseph Explorations Limited.

One hole on claim KRL 504043 at azimuth 334 degrees, dip below horizontal 45 degrees, for 85.34 m indicated a sequence of felsic to intermediate metavolcanics, argilliceous metasediments, and massive sulphide mineralization finally terminating in granodiorite. The massive sulphide mineralization extended from

TABLE 6. SAMPLE LOCATIONS AND ASSAY VALUES, ST. JOSEPH EXPLORATIONS LIMITED, SLATE LAKE GRID 16 (10.2).

St. Joseph Grid Reference	Author's No. From East to West	Au (oz/ton)	Ag (oz/ton)
L3E/1+00S	HS - 24 - 80	Tr <0.01	Tr <0.01
L2W/2+25S	HS - 25 - 80a	Tr <0.01	Tr <0.01
Not covered	HS - 60 - 80	Tr <0.01	Tr <0.01

Sample analyses by Geoscience Laboratories, Ontario Geological Survey, Toronto.

51.6 to 52.27 m or over 0.51 m and analyzed for Au, Ag, Cu, Zn, and Sn with nil results.

Another hole on claim KRL 504041 at azimuth 334 degrees, dip below horizontal 45 degrees, for 88.39 m intersected intermediate to felsic metavolcanics and two bands of massive sulphide mineralization. The uppermost from 64.11 to 61.46 m or over 0.35 m analyzed for Au, Ag, Cu, Zn, and Sn with nil results. The second from 81.78 to 82.08 m or over 0.30 m analyzed for Au, Ag, Cu, Zn, and Sn with nil results.

Slate Lake Grid 15 (10-3)

Grid 15 consists of two contiguous claims KRL 506810 and 506811. These were staked in 1978 and geologically mapped that year. The claims are underlain by a sequence of felsic to intermediate metavolcanics consisting of massive flows, tuff, lapilli-tuff, and tuff-breccia. Some biotite granite and quartz-feldspar porphyry were reported, however, the author believes these to be porphyritic flow units. The trend of the rock units is generally east-west dipping sharply to the south.

Chloritic and sericitic alteration was noted and some areas exhibit shearing.

Two small gossans containing finely disseminated pyrite and pyrrhotite crystals were reported by company geologists. Pyrrhotite fragments were also reported in a felsic breccia.

Ground magnetic and electromagnetic work was recommended, however, it was never reported in assessment file data.

Two holes were diamond drilled in 1979 on the north-south claim boundary separating the two claims. Both were drilled at azimuth 355 degrees.

The first was drilled 55 degrees below horizontal for 94.48 m and intersected a felsic to intermediate sequence and a quartz diorite dike. Mineralization was not considered significant enough to warrant assays.

The second hole was drilled 25 m north of the first hole at 45 degrees below horizontal and intersected a sequence of felsic to intermediate metavolcanics and slate-argillite with graphite, pyrite, and the quartz diorite dike. Sulphide mineralization was noted in the slate-argillite between 17.8 to 19.01 m or over 1.23 m and analyzed for Au, Ag, Cu, Zn, and Sn with nil results.

The second mineralized zone was between 21.18 and 27.71 m or over 1.52 m and also returned nil values. Further work on these claims has not been reported, although company geologists recommended that a ground magnetometer and horizontal loop electromagnetic survey be run.

Maskooch Lake Grid 1 (10-4)

Grid 1 consists of six contiguous claims KRL 471513 to 471518 inclusive that were staked in 1971 and is located roughly 300 m northeast of Maskooch Lake.

TABLE 7. DRILL CORE LENGTH AND ASSAYS, ST. JOSEPH EXPLORATIONS LIMITED, MASKOOCH LAKE GRID 1 (10-4)*.

From	To	Length	Au (oz/ton)	Ag (oz/ton)	Cu (%)	Zn (%)
40.13 m	41.09 m	0.61 m	Nil	Tr	0.06	Tr
50.44 m	51.05 m	0.61 m	Nil	Nil	0.07	0.01
51.82 m	52.43 m	0.61 m	Nil	Nil	0.06	0.02
53.49 m	54.10 m	0.61 m	Nil	Nil	0.07	0.01

**Data from Assessment Files Research Office, Ontario Geological Survey, Toronto.*

A ground magnetometer and electromagnetic survey were conducted over 8 line kilometres of grid.

A very broad magnetic response and electromagnetic conductor were delineated with a southeastward trend which parallels the general trend of the underlying rocks in this area. These rocks are felsic to intermediate metavolcanic tuff to lapilli-tuff with some tuff-breccia units intruded by the Maskooch Lake high-level intrusion which is a quartz-feldspar porphyry.

The anomalous zone roughly coincides with the inferred contact of the intrusive body and is believed to be caused by sulphide mineralization and magnetite associated with the intrusion and the felsic to intermediate metavolcanic units.

A diamond-drill hole put down on claim KRL 471518 at azimuth 360 degrees at 45 degrees below horizontal intersected an intermediate volcanic sequence, some quartz diorite, and two zones of mineralization containing magnetite, pyrite, pyrrhotite, and chalcopyrite. The larger of the mineralized zones extended from 40.48 to 54.39 m.

Four 0.61 m sections of core were split by the company and assayed with results as shown on Table 7. No further work has been reported for these claims.

Maskooch Lake Grid 2 (10-5)

Grid 2 consists of 25 contiguous claims numbered KRL 471497 to 471512 inclusive and KRL 471538 to 471546 inclusive that were staked in 1977.

A geophysical survey was carried out in 1978.

The grid is underlain largely by eastward trending felsic to intermediate metavolcanics ranging from porphyritic flows to pyroclastic breccia intruded by mafic dikes and a quartz-feldspar porphyry high-level intrusion. A metasedimentary unit consisting of polymictic orthoconglomerate bounds the metavolcanics to the south.

A number of relatively short magnetic anomalies were detected, none of which show any coherent pattern. However, when the electromagnetic data are superimposed on the magnetic data, some distinct structural trends become apparent.

The nose of a fold appears to be extending from the southeastern tip of Maskooch Lake. This is now supported by field geological data largely because of an absence of outcrop in this area. The author believes the electromagnetic conductors are caused by a concentration of sulphide mineralization and possibly graphite along bedding planes and contacts that were concentrated or injected by processes associated with the Maskooch Lake high-level intrusion. Some of the conductors can be attributed to the contact between the metavolcanics and the intrusion. Others appear to be associated with flow boundaries in the metavolcanic

TABLE 8. DRILL CORE LENGTH AND ASSAYS, ST. JOSEPH EXPLORATIONS LIMITED, MASKOOCH LAKE GRID 2 (10-5)*.

From	To	Length	Au (oz/ton)	Ag (oz/ton)	Cu (%)	Zn (%)
71.68 m	72.32 m	0.64 m	Tr	Tr	Tr	0.02
72.37 m	72.48 m	0.16 m	Tr	Nil	Tr	Tr

**Data from Assessment Files Research Office, Ontario Geological Survey, Toronto.*

sequences and the mafic dike intruding the metasedimentary and metavolcanic sequences.

A diamond-drill hole was drilled on claim KRL 471511. The drillhole intersected gabbro and felsic and intermediate metavolcanics with a 0.8 m mineralized zone of 3 to 4 percent disseminated pyrite and pyrrhotite located within the felsic metavolcanic sequence.

Samples of this unit, submitted by the company, assayed results as shown on Table 8.

No further work has been reported from these claims.

Wassa Bay Grid (10-6)

The Wassa Bay Grid consists of six contiguous claims KRL 518481 to 518486 inclusive and were staked in 1979. Detailed geological mapping was done in 1979 followed by ground magnetic and electromagnetic surveys in 1980.

The grid is underlain in the northern part by northeastward to eastward trending volcanically derived wacke and in the southern part by felsic to intermediate metavolcanics, and a felsic intrusion of syenite to monzonitic to quartz monzonitic composition.

The magnetic and electromagnetic anomalies roughly follow the contact of the pluton with the metavolcanic-metasedimentary sequence and is most probably caused by minor magnetite and sulphide mineralization along the contact and in interfingering fractures caused by the intrusive forces. Magnetic and electromagnetic correlation is not well developed and the author believes that because of this fact mineralization will not likely be well developed. Water-saturated fractures and contact zones have been known to produce electromagnetic anomalies (Parasnis 1973).

No further work has been reported for this grid.

Tepeka Creek Grid (10-7)

The Tepeka Creek Grid consists of six contiguous claims KRL 518487 to 518492 inclusive and were staked in 1979. Detailed geological mapping was done in 1979 followed by ground magnetic and electromagnetic surveys in 1980.

The grid is underlain by volcanically derived eastward trending wacke, arkose, and interbedded felsic and mafic metavolcanics. The geophysical survey delineated a magnetic anomaly and an electromagnetic conductor that correlate well and correspond with the mafic volcanic flows enclosed by the wacke sequences.

The company field geologist recommended detailed magnetic and electromagnetic surveys to gain additional information on the anomalies with gravity profiles over the main magnetic and electromagnetic anomalies. These surveys are to be supported by detailed geology and soil and rock geochemistry.

Neepawa Bay Grids 6, 36, and 37 (10-8A, 10-8B, 10-8C)

Grid 6 (10-8A on Figure 22) consists of two contiguous claims KRL 542247 and 547248 which were staked in 1979 and for which no assessment work has been filed. Northeastward trending mafic and intermediate metavolcanics underlie these claims.

Grid 36 (10-8B on Figure 22) consists of four contiguous claims KRL 547255 to 547258 inclusive that were staked in 1979. These claims are underlain by northeastward trending mafic to intermediate metavolcanics and volcanically derived arkose and wacke. ground magnetic and electromagnetic surveys were run. Geophysical anomalies are within the metasedimentary sequence. Two conductors with moderate magnetic correlation were delineated. The author believes the anomaly in the southeastern corner of the claim group is caused by the Uchi Lake Fault, whereas the anomaly trending northeastward through the centre is stronger and coincides roughly with the contact between the metasediments and the mafic metavolcanics and could indeed be mineralized.

The company field geologist recommended further magnetic and electromagnetic profiling using multiple coil separations, and multiple frequencies supported by gravity profiling in order to better determine the causes.

No further work has been submitted for these claims.

Grid 37 (10-8C on Figure 22) consists of four contiguous claims, KRL 547251 to 547254 inclusive, that were staked in 1979. These claims are underlain by a sequence of northeastward trending pillowed mafic metavolcanic flows and intermediate metavolcanics which are tuffaceous in nature and are intruded by a mafic dike. A magnetitic chert interlayered with magnetitic ironstone bed cuts the northeastern corner of the grid. Ground magnetic and electromagnetic surveys were run by St. Joseph Explorations Limited over two claim blocks (*see* Figure 22). Magnetic anomalies and electromagnetic conductors reflect the ironstone and the mafic dike which appears to separate the intermediate metavolcanics in the northwestern part of the grid from the mafic metavolcanics and metasediments underlying the southeastern part of the grid.

Further work recommended by the company field geologist included running additional electromagnetic survey lines having multiple frequencies and longer coil separations. Gravity profiles were also advised.

No further work has been submitted for these claims.

Wenasaga River Grids 3 and 4 (10-9A, 10-9B)

Grid 3 (10-A on Figure 22) consists of four contiguous claims, KRL 483659 to 483662 inclusive, staked in 1977 and is located approximately 5 km above Upper Slate Lake on the west bank of the Wenasaga River. A ground magnetometer and electromagnetic survey was conducted over the claims in 1978 on a grid laid out with a base line at azimuth 90 degrees along the line dividing the northern two claims from the southern two claims.

The grid is underlain by felsic and intermediate metavolcanics with some volcanically derived metasediments (siltstone and argillite) in the northeastern part of the group. A magnetic anomaly coinciding with an electromagnetic conductor trending eastward approximately 125 m south of the base line was detected. This is roughly along the trend the author interpreted to be a contact between felsic and intermediate metavolcanics. The company interpreted the response to be caused by sulphide mineralization, which is reasonable. The metasediments to the east of the claim group contain 10 to 15 percent sulphide mineralization in places.

The company recommended further detailed mapping and prospecting around the anomalies to attempt to better understand the cause of the geophysical anomalies. However, nothing further was done.

Grid 4 (10-9B on Figure 22) consists of four contiguous claims, KRL 483655 to 483658 inclusive, staked in 1977 and is located on both the east and west banks of the Wenasaga River approximately 5 km above Upper Slate Lake. A base line at azimuth 90 degrees was laid out along the line dividing the northern two claims from the southern two claims. A geophysical survey consisting of ground magnetometer and ground electromagnetic surveys were conducted over this grid in 1978.

This grid is underlain almost exclusively by volcanically derived siltstone and wacke with possibly some intermediate metavolcanic units.

A fairly strong conductor 500 m long trending almost due eastward along the base line roughly coincided with three *en echelon* 200 to 300 m long magnetic highs. The anomaly is likely caused by sulphide mineralization concentrated along the bedding of the metasedimentary sequences. The company recommended more detailed mapping and prospecting with a possible follow-up with soil sampling and rock geochemistry to determine the cause of these anomalies.

Slate Lake Grids 6 and 7 (10-10A, 10-10B)

Grid 6 (10-10A on Figure 22) began as four contiguous claims, KRL 483667 to 483670 inclusive, staked in 1971.

These claims were located along Panama Creek roughly 800 m downstream (east) from Panama Lake or 3.5 km upstream (west) from Upper Slate Lake.

A geophysical survey consisting of a ground magnetometer and a horizontal loop electromagnetic survey was conducted in 1978. A detailed mapping program was also conducted.

Only rough correlation between magnetic and electromagnetic data was obtained with one fairly strong conductor noted, although it did not persist over a very long strike-length. This conductor was diamond drilled in 1979 by St. Lambert Drilling in a weaker part about 100 m farther east of the greatest electromagnetic magnitude at azimuth 336 degrees at 60 degrees below horizontal for a length of 190.85 m. Examination of a cross section of this drillhole and plotted by the author establishes that the anomalies are caused by sulphide mineral concentrations along contacts between the various intermediate metavolcanic and metasedimentary units. This is a common phenomenon encountered when prospecting for massive sulphide minerals. The author believes that these conductors should be further examined by running a few gravity profiles and drilling only where significant gravity highs are found.

Assay values reported for this hole by the company are shown on Table 9.

In 1979 a further 25 claims were staked around the original four claims bringing the number of claims comprising Grid 6 to 29 contiguous claims. These additional claims are KRL 518493 to 518513 inclusive and KRL 503382 to 503385 inclusive. This was followed by detailed mapping (W.R. Rayner, Geologist, St. Joseph Explorations Limited, personal communication, 1980), a ground magnetometer survey in 1979, and a horizontal loop electromagnetic survey in 1980. The claim group is underlain by a thick sequence of northeastward trending to steeply south dipping mafic to felsic metavolcanics ranging from pillow basalt to felsic tuff and lapilli-tuff and tuff-breccia with some interbedded volcanically derived metasediments ranging from argillite to wacke. Company geologists believe there are a number of diorite dikes or sills intruding the area and indeed some may, however, the author feels most are thick flows or the coarser lower parts of flows. This conclusion is supported by the many pillow selvages seen in these coarse-grained units. Some pillows range up to 1 m in diameter. Smaller pillows are also found as well as pillow breccia. The finer grained upper parts of the flow units appear less mafic and give rise to an intermediate appearance in the field. Tops appear to be generally southward in orientation and graded bedding in

TABLE 9. DRILL LENGTH AND ASSAYS, ST. JOSEPH EXPLORATIONS LIMITED, SLATE LAKE GRID 6 (10-10A)*.

From	To	Length	Au (oz/ton)	Ag (oz/ton)	Pb (%)	Zn (%)	Cu (%)
130.43	130.92	0.49	Nil	Nil	Tr	0.01	0.01
130.92	131.40	0.48	Tr	Nil	Tr	0.01	Tr
131.40	131.89	0.49	Nil	Tr	Tr	0.03	0.01
131.89	132.38	0.49	Nil	Nil	0.01	0.01	0.01
132.38	132.87	0.49	Tr	Nil	0.01	0.16	0.05
132.87	133.35	0.48	Nil	Nil	0.01	0.11	0.01
134.63	135.61	0.98	Tr	Nil	Tr	0.06	0.01
137.26	137 74	0.48	Nil	Nil	Tr	0.02	Tr
142.68	143.17	0.49	Nil	Nil	Tr	0.02	Tr
143.17	144.15	0.98	Tr	Nil	Tr	0.02	Tr
161.59	162.56	0.97	Nil	Nil	Tr	0.02	Tr
177.29	177.77	0.48	Nil	Nil	Tr	0.03	0.06
177.77	178.26	0.51	Tr	Nil	Tr	0.02	0.03
178.26	178.75	0.49	Tr	Nil	0.19	0.41	0.53
178.75	178.84	0.09	Tr	1.10	0.04	9.06	0.51
178.84	179.33	0.49	Tr	Nil	0.01	0.03	0.07

Data from Assessment Files Research Office, Ontario Geological Survey, Toronto.

many of the metasediments substantiates this. Where grading indicates a northward trending top this could be caused by folding. Northward trending tops, indicated by the graded bedding, could be a result of folding.

Magnetic response is greatest over the more dense mafic sequence. Response over the felsic to intermediate units is nil, or is characterized by magnetic lows. Most of the conductors are probably related to contacts between the various metavolcanic and metasedimentary units. The stronger conductors may carry significant quantities of sulphide mineralization and company geologists recommend further detailed geophysical surveys to better delineate targets.

Grid 7 (10-10B on Figure 22) began as four contiguous claims, KRL 483663 to 483666 inclusive, staked in 1977 and are located about the central part of the south shore of Panama Lake. The area is underlain by a sequence of northeastward trending intermediate to mafic metavolcanic pillow lavas with possibly some thin felsic tuffaceous units.

A geophysical survey consisting of a ground magnetometer and electromagnetic survey was conducted in 1978 coupled with detailed geological mapping. A further 36 claims, KRL 509210 to 509213 inclusive, 518514 to 518522 inclusive, and 518458 to 518480 inclusive, were staked in 1979. This was followed that year by detailed mapping (W.R. Rayner, Geologist, St. Joseph Explorations Limited, personal communication, 1980) (not submitted) and, in 1980, by a ground magnetometer survey, an induced polarization survey, (not submitted), and a horizontal loop electromagnetic survey. A crystal tuff or felsic high-level intrusion occurs in the area and needs further petrographic and rock geochemistry for classification. This type of work will also be necessary across the whole metavolcanic sequence to separate the various metavolcanic, metasedimentary, and intrusive units. The westernmost position of this claim group is mapped by company geologists as intermediate metavolcanic tuff to crystal tuff. The author noted a considerable graded bedding and concludes that a high percentage of the rock is volcanically derived metasedimentary wacke and siltstone.

TABLE 10. DRILL CORE LENGTH AND ASSAYS, ST. JOSEPH EXPLORATIONS LIMITED, SLATE LAKE GRID 7 (10-10B)*.

From	To	Length	Au (oz/ton)	Ag (oz/ton)	Cu (%)	Zn (%)
30.5	31.0	0.5	Tr	Nil	Nil	0.01
31.0	31.2	0.2	Tr	Nil	Nil	0.02
31.2	32.2	1.0	Tr	Nil	Nil	Tr
32.2	33.2	1.0	Tr	Nil	Nil	Tr
33.2	34.2	1.0	Tr	Nil	Nil	0.01
34.2	35.2	1.0	Tr	Nil	Nil	0.02
35.2	36.2	1.0	Tr	Nil	Nil	0.02
36.2	37.2	1.0	Tr	Nil	Nil	0.01
37.2	38.2	1.0	Tr	Nil	Nil	0.01
38.2	39.2	1.0	Tr	Nil	Nil	0.01
39.2	40.2	1.0	Tr	Nil	Nil	0.01
40.2	41.2	1.0	Tr	Nil	Nil	0.02
41.2	41.9	0.7	Tr	Nil	Nil	0.01

**Data from Assessment Files Research Office, Ontario Geological Survey, Toronto.*

The magnetic trend follows the mafic metavolcanic sequence of pillow basalt and pillow breccia very well across the grid. Magnetic lows on either side of the magnetic high indicate metasedimentary and felsic to intermediate volcanic sequences.

Electromagnetic conductors appear to be largely formational in nature except for the conductors just north of the narrows at the southwestern outlet of Slate Lake proper. This conductor was diamond drilled in 1979 at azimuth 350 degrees at 45 degrees below horizontal for a length of 91.4 m.

A felsic lapilli-tuff and tuff-breccia intersection from 30.5 and 41.9 m with 2 to 5 percent disseminated sulphide mineralization is reported by the company to have returned assay results as shown in Table 10.

About 800 m east of this diamond-drill hole on the north side of the small peninsula the author encountered an outcrop of interlayered magnetitic chert and magnetitic ironstone which may account for the electromagnetic conductor passing through that location. This is also close to the contact between the mafic metavolcanic sequence to the north and the metasedimentary wacke sequence to the south.

Similar recommendations to those given by the company geologist should be followed in further work such as more detailed geophysical surveys over the existing conductors to better understand them. The crystal tuff/felsic high-level intrusion exhibits extensive carbonatization and certainly warrants further rock geochemistry in order to better ascertain its potential.

TEX-SOL EXPLORATIONS LIMITED (11)

In 1956, Tex-Sol Explorations Limited staked the Avis Lake or Kesaka Lake property comprising 124 claims numbered as follows: KRL 40139 to 40150 inclusive; and KRL 39511 to 39622 inclusive.

Newkirk Mining Corporation Limited (Ontario charter 1953) contracted Aeromagnetic Surveys Limited in 1956 to conduct an airborne magnetic survey over a 172 km by 1.6 km area with the long axis oriented in an eastward direction. El-Sol staked or acquired two claim groups covering areas of significant airborne magnetic anomalies. One was this group, and another has been de-

scribed earlier under the heading El-Sol Gold Mines Limited. Quebec Labrador Development Company Limited staked another claim group over yet another airborne magnetic anomaly and this area is also described above. Newkirk's role in this venture is unclear, but they apparently staked some ground in adjoining areas. Newkirk Mining Corporation Limited is mentioned only by W.R. Montgomery in a 1956 geological report for El-Sol Gold Mines Limited on behalf of Newkirk Mining Corporation. Newkirk Mining Corporation Limited became Continental Mining Exploration Limited in 1957 and was taken over by Augustus Exploration Limited (Ontario Charter 1953) who reported claim holdings in the Papaonga Lake area in the Canadian Mines Handbook beginning in 1961 (Northern Miner Press 1961, p.16). In 1967, Augustus became Consolidated Canadian Faraday Limited and continued to report iron ore properties each year until 1972 after which no further report of claims held was made in the Canadian Mines Handbook. El-Sol Gold Mines Limited became controlled by Augustus Exploration Limited in 1962 and was reorganized as Tex-Sol Exploration Limited in 1964.

El-Sol Mines Limited did sufficient work to lease the 124 claims mentioned above. El-Sol contracted Geo-Technical Development Company Limited to assess the property and conducted geological mapping aided by a dip needle survey and a ground magnetometer survey covering 67 of the 124 claims: KRL 39558 to 39564 inclusive; KRL 39524 to 39540 inclusive; KRL 39590 to 39611 inclusive: KRL 39516 to 39521 inclusive; KRL 39573 to 39577 inclusive; KRL 39562 to 39564 inclusive; KRL 39511 to 39513 inclusive; KRL 39601 to 39603 inclusive; KRL 39617 to 39622 inclusive; KRL 39582; KRL 39595 and 39596. Two significant magnetic anomalies were delineated on the ground. The A Zone measured 13,200 feet long and the B Zone measured 7200 feet long. Both trend parallel to the eastward regional strike of the underlying units. The width measured 400 to 500 feet. Smaller Zones C, D, E, F, and G measuring 600 to 1500 feet in length were also delineated between the northern A Zone and the B Zone about 1200 to 2000 feet south of the A Zone. Two extremely small anomalies, the H and I Zones were located on the western property boundary and just north of the A Zone, but were thought to be of little interest. From the author's field examination it appears that the I Zone is part of the ironstone unit extending from the western property boundary westward to south of Tepeka Lake. Figure 23 (*see* Chart A, back pocket) provides details of the diamond-drill holes and ironstone intersections.

The claim group is underlain by a sequence of mafic to intermediate metavolcanics, tuff to pillow basalt, metasediments ranging from conglomerate to arkose, and diorite stocks south of Tepeka Lake and southwest of Avis Lake. These rocks trend northeastward to eastward in the western part of the claim group and trend eastward to southeastward in the eastern part of the claim group. The dips are vertical to steeply south. Tops also tend to be southward in orientation. The northern sequence of mafic metavolcanics appears to be tuffaceous commonly with alternating layers of amphibolite and feldspar-rich sandy appearing layers. Garnets are common throughout ranging in size up to 1 mm. The larger amphibolite beds contain garnet porphyroblasts up to 2 cm and some garnets are so prevalent they form bands which are highly contorted. Metamorphic grade is a least amphibolite facies. This unit could be a metasediment and awaits petrographic and geochemical work. This unit measures 8000 feet along strike by 1000 feet thick.

Trending across the claim group between Kesaka Lake and Avis Lake is a sequence of pillow basalts some 1000 feet thick. Just south of the first mentioned mafic unit is a sequence of intermediate tuff to tuff-breccia. This unit is medium to light grey with 15 to 20 percent biotite. Veins and fracture-fillings of albite and epidote are common indicating the quartz-albite-epidote-biotite subfacies de-

scribed by Winkler (1967). The metasediments are generally coarse conglomerate and wacke in the northern part of the claim group; the ironstone separates them from the wacke to arkose units to the south.

Nearly all clasts are lens shaped and near the ironstone unit some ironstone clasts are encountered in a wacke matrix. This conglomerate unit is repeated and could be part of a series of isoclinal folds. This could also be true of the two parallel bands of ironstone. Gabbro to diorite is the only intrusive rock found on the property. The Tepeka Lake Pluton is somewhat darker and finer grained than the Papaonga Lake Pluton and does not appear to have the biotitic inclusions common in the latter. In the extreme southeastern part of the claim block lying within the map area, there is an outcrop of tonalite with biotite clots. This is representative of the Papaonga Lake Pluton.

The magnetitic chert interlayered with magnetite ironstone is the single unit of potential economic value on the property. The interlayered bands may also be argillaceous to arenaceous in composition and the chert is commonly bluish white. Some jasper has been reported in drill core logs. Reports of carbonate in the metasediments in geological reports and drill logs are rare. Geo-Technical Development Company Limited personnel cut a channel sample across an ironstone outcrop on the north shore of Kesaka Lake in 1956 which assayed 31.74 percent Fe over 26.5 feet. The author located this channel in 1980 and recut it over the same length and received an analysis of 31.8 percent Fe and 0.02 percent P.

Although considerable folding is suspected to have taken place, faulting has not been observed except on a small scale.

Geo-Technical Development Company Limited recommended an extensive diamond-drill program which was carried out in 1956 and 1957. Most holes were from 400 to 600 feet long at 45 degrees below horizontal with a few holes of shorter length and two over 1600 feet. All but one were oriented north. Vertical depth was on the order of 250 to 350 feet. A total of 33 998 feet of diamond drilling in 67 holes was done which positively delineated the A and B Zones. The accompanying map (Figure 23) shows the location of the diamond-drill holes and the projection updip (dip is roughly 80 degrees south) to the 1300 feet above sea level elevation. This elevation was assumed by workers at that time to be the water level on Kesaka Lake.

In 1958, H. Brodie Hicks, P.E., prepared a preliminary engineering study for the company in which reserves were calculated with assay values of 31.1 percent iron to a depth of 1000 feet. This vertical depth was encountered in the two deepest diamond-drill holes. Hicks used a tonnage factor of 312,550 tons per vertical foot to arrive at reserves of 312,550,000 tons. The narrow width of the deposit would make open pit mining unfeasible below 400 to 440 feet from surface and Hicks proposed underground mining down to 1000 feet.

A composite of 69 assay office rejects was reported by Lakefield Research Limited as follows: Fe (total) 33.860 percent; Fe (acid soluble) 31.200 percent; Cu 0.016 percent; S 0.260 percent; P 0.084 percent; and TiO_2 0.210 percent.

The author roughly calculated from diamond-drill logs that sulphur is in the 0.15 to 0.26 percent range, P_2O_5 values are in the 0.22 to 0.35 percent range, and SiO_2 averages 45 to 47 percent. The author had seven samples and one from this claim group was analyzed for iron and phosphorus. Values between 16.2 and 38.7 percent Fe, and 0.02 and 0.06 percent P were obtained (Geoscience Laboratories, Ontario Geological Survey, Toronto).

Metallurgical testing was performed by Lakefield Research Limited of Lakefield, Ontario, and the Lurgi plant. The most extensive tests were performed by the Lurgi plant. Samples were comprised of 725 assay office rejects representing 6900 feet of diamond-drill core with a total weight of 4750 pounds. Tests were

carried out in June and November 1957 and included microscopic examination of polished sections, Davis Tube separation tests, production of concentrates, and pelletization of those concentrates. A summary of the Lurgi plant results gives the following.

Material was ground until 100 percent passed through a 325 mesh classifier.

Final iron concentrates analyzed 70.8 percent Fe and 2.0 percent silica.

Pellets made from this concentrate analyzed 68.39 percent Fe and 2.2 percent silica.

A July 1957 report stated that tailings could be kept within 4 to 7 percent iron content and that 88 to 90 percent of the iron could be recovered.

In summarizing the metallurgical data, it appears that a premium pellet could be produced by magnetic concentration and pelletization and that 85 to 90 percent of the iron could be recovered with a concentrate grade of 70 percent, or a 2.5:1 concentration ratio.

In 1969, M.W. Bartley and Associates Limited of Port Arthur (now Thunder Bay), Ontario, prepared a preliminary economic appraisal of the property. Bartley proposed three approaches to mining the deposit:

Case 1: The stripping ratio not to exceed 0.85 cubic yards of rock to one long ton of pellet product.

Case 2: The A Zone would be mined to a depth of 450 feet and the B Zone would be mined to a depth of 360 feet.

Case 3: Further deepening of the A Zone pit eastward from Section 4+00 West would be done after mining the A and B Zones as in Case 2.

Bartley arrived at the following reserve tonnage and stripping ratios for each of the three cases.

Reserves	**Case 1**	**Case 2**	**Case 3**
Crude long tons	41,172,728	65,982,140	72,142,131
Crude iron	32.80%	32.80%	32.80%
Weight recovery	36.20%	36.20%	36.20%
Pellet long tons	14,912,430	22,564,436	24,919,481
Stripping Ratios			
Surface (cu.yds.:ton)	0.41:1.00	0.45:1.00	0.44:1.00
Rock (cu.yds.:ton)	0.84:1.00	2.38:1.00	2.48:1.00

Ore would be ground until 100 percent past 325 mesh in all cases.

Pellet analysis would be 67.75 percent Fe and 2.72 percent SiO_2.

Annual production would be 1,000,000 long tons.

SUGGESTIONS TO PROSPECTORS

Recommendations for future mineral exploration on ground not currently held include the following.

1. The potential of the magnetitic jasper interlayered with magnetite ironstone north of Tepeka Lake could be further assessed.
2. The carbonatized mafic metavolcanics along the south shore of the southwestern part of Slate Lake and along the north shore of Sawan Bay could bear closer examination.
3. More work such as sampling and possibly drilling of the ironstone north and south of the Papaonga River between Badrock Lake and West Badrock Lake may prove profitable.

4. The felsic metavolcanic sequence north and east of Maskooch Lake and the feldspar porphyry surrounding Maskooch Lake offer possibilities for precious metal and base metal exploration. There have been a number of magnetic anomalies and electromagnetic conductors delineated that have yet to be tested or further examined. The felsic to intermediate volcanic breccia trending southeastward from the southern end of Maskooch Lake could have provided a plumbing system for ore carrying solutions to percolate through and deposit mineral concentrations in the stockwork.
5. The felsic metavolcanic sequence between the Wassa Bay Pluton and the West Badrock Lake Pluton could be extensively prospected.
6. The metavolcanic sequence in the northwestern part of the map area has been closely examined by Dome Exploration (Canada) Limited in 1969 to 1970 and St. Joseph Explorations Limited more recently. However, some of the electromagnetic conductors and magnetic anomalies may bear further examination.

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